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MEMOIR ON SWORDS,

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BY

COLONEL MAREY,

COMMANDING THE 1ST REGIMENT OF CUIRASSIERS.

TRANSLATED FROM THE FRENCH

BY

CAPT. & LIEUT.-COL. HENRY HAMILTON MAXWELL,

BENGAL ARTILLERY.

TO WHICH ARE ADDED

NOTES AND ENGRAVINGS.

ALSO

TRANSLATOR OF CAPTN. TAUBERT'S WORK ON THE USE OF FIELD ARTILLERY ON SERVICE, FROM THE GERMAN, BEING VOL. 113 IN THE SERIES.

LONDON:

JOHN WEALE, 59, HIGH HOLBORN.

1860.

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CHAPTER I.—EXAMINATION OF THE PRINCIPAL ARMS IN EXISTENCE, USED FOR CUTTING AND THRUSTING, AMONG VARIOUS NATIONS.

CHAPTER II.—GENERAL RECAPITULATION OF PROPOSALS . . .

LIST AND EXPLANATION OF THE PLATES.

1.—To illustrate the form of the Turkish sword-hilt. This sabre is copied from specimen No. 845, U. S. Museum, Whitehall, and has the following legend attached to it :—"Damascus Sabre, given by Yussuf Karaman Ali, Pasha of Tripoli, to Captain W. H. Smyth, R.N., K.F.M." It is flame-shaped, as recommended by the author for ships' cutlasses, or other blades which are not worn in scabbards. This flamboyant shape was common enough in the old straight long double-handed swords of the chivalric era.

2.—British Old Pattern Light Cavalry Sword ; the old point of which has been cut off to bring the new point nearer to the line of impulse, and thus to improve its thrusting capabilities.

2 *b*.—British New Pattern Light Cavalry Sword.

2 *c*.—New Hilt as applied to the blade of the above. There is strictly no "tang" to this sword ; but the blade is prolonged to the length of the hilt. Two pieces of solid leather are then riveted, one on each side, of the prolongation of the blade, which is visible at the back and front. This arrangement has the important advantage of strengthening the attachment of the blade and hilt. The old method was subject to the inconvenience of the sword-tang getting loose in the grip, and not unfrequently the sword broke off at the tang, in giving a powerful blow.

3.—Illustrates the action of cutting, and the manner in which a sliding cut backwards or forwards has the same effect as though

the blade were infinitely sharper than it actually is. (Borrowed from Piobert).

Fig. 4.—Illustrates the effect of wounds made with sabres of various degrees of curvature, and the high ratio of increase as the angle of curvature increases.

Fig. 5.—Illustrates the mechanical effect of a blow as regards the different parts of a sword.

Fig. 6.—Ditto ditto.

Fig. 7.—Illustrates the recommendation of the author that the thickness of the metal of swords intended for striking should be greatest, not at the back as is usually the case, but at the middle, or at two-thirds of the breadth measured from the edge. This blade, however, is thickest still nearer the edge, being at about one-third of the breadth therefrom. This figure is a copy of a sketch I made in Turkey, of a sword the property of an officer in the Ottoman service. The weapon was made at Baghdad. The steel was of the quality termed "Tabau," and its peculiar shape is called "Bala," an appellation it may have got from its great power of cut, or, technically, percussive force; the word "bala," in Arabic, meaning "vengeance." It was valued by its owner at 7000 piastres, or about 55*l.* to 58*l.*

Figs. 8, 9 *a*, 9 *b*, 10, and 11.—Sections of various forms of swords, varied so as to stiffen the blade.

Figs. 12 to 20, both inclusive, illustrate the mechanical effect of the point.

Figs. 21 to 25, both inclusive, illustrate the nature of wound made in giving the curved point.

Figs. 26 to 32, both inclusive, illustrate the nature of wound, as well as the forces developed, in giving the straight-point.

In both these sets of illustrations, the light shading shows the body wounded, and the dark shading the shape of the wound itself.

Fig. 33.—Shows the form of the wound made by a blade moving onwards in a plane, and at the same time revolving in the same plane round the heel of the hilt. The above remark as to shading applies to this figure likewise.

34.—Illustrates the blade having the edges at its concavity. This figure is copied from a yataghan in the Tower Armoury.

35.—Illustrates the fact, that a blade acting with an edge oblique to the direction of the cut has the same effect as a blade whose edge is perpendicular to it, but whose line of action is oblique at the surface of the body struck. This figure is a copy of the axe of a guillotine, specimen, No. 1593 of the United Service Museum collection; the trapezoidal blade is attached to a block of wood, on the edges of which are tenons fitting the metal grooves of the two uprights of the scaffold. On the top of the block of wood is a mass of lead, to increase the momentum, fastened thereto by means of screw-bolts which run through from below, and are tightened by the screw-nuts at top. The dimensions given in the figure are in English inches. The following legend is attached to it:—"The axe of a guillotine, cut down by the late Admiral Scott, at Guadaloupe, in 1794, at the taking of the West India Islands. Fifty Royalists had already been decapitated by it."

36.—Illustrates the same as Fig. 34. This weapon is called the "Khora." It is Nepaulese, and is used, I believe, for sacrifices. Such feats as cutting a bullock's head off, or cutting a sheep through, at one stroke, are to be done with this arm.

37.—Is the "Khookhri," or Nepaulese knife. It is used by these mountaineers in war, and in every other possible way, from cutting down a huge tree to making a toothpick, or executing very creditable carving. The ridge on the handle seems to European hands ill-devised.

38, 39, and 41, illustrate the shapes of daggers suitable to the thrust, with the blade nearest the thumb or nearest the little finger, or in other words for the straight or the curved stab. They are all of Hindoostanee manufacture, though, possibly, of Affghan origin.

40.—Is a curious weapon, both offensive and defensive, combining a shield with two curved daggers: the latter are mounted in stag's horns.

42.—Is a curiosity in the way of small-arms. It combines the thrusting-dagger and percussion-pistol. It is of Circassian manu-

facture, and was sketched by myself in Turkey. It is the pr
of Moustapha Pasha, Lieut.-General in the Imperial Ott
service. The blade is 16·5″, the barrel of the pistol 4″, a
hilt 6″ in length.

Fig. 43, 43 *a*, 43 *b*, 43 *c*, 43 *d*.—The Hindoostanee Tulwar, drawn to
measurement, one-fifth of actual size.

Fig. 44.—French Sword of the Cavalry of the Line.

Fig. 45.— ,, ,, of the Light Cavalry.

Fig. 46.— ,, ,, of the Horse Artillery.

Fig. 47.— ,, ,, of Infantry, termed "briquet."

Fig. 48.— ,, ,, of ,, termed "coupe-choux."

Fig. 49.— ,, Sword-bayonet, of the yataghan form, adapted to
and lately adopted by the British Government.

Fig. 50.—French Naval Cutlass.

Fig. 51.—Old French Light Cavalry Sword, termed "bancal," in xi.

Fig. 52.—Old ,, Heavy ,, in xiii.

Fig. 53.—New ,, ,, ,, in 1816.

PLATE 1.

Fig. 1.

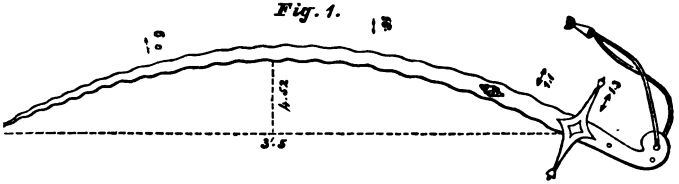


Fig. 3.

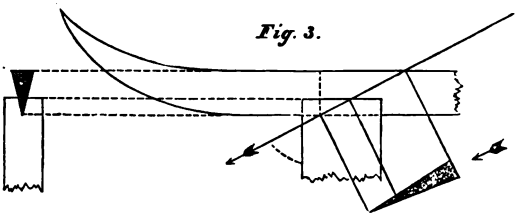
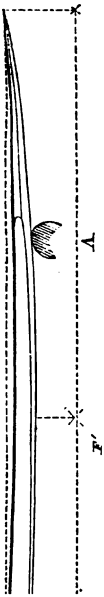


Fig. 5.



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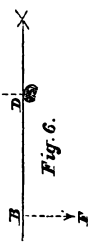
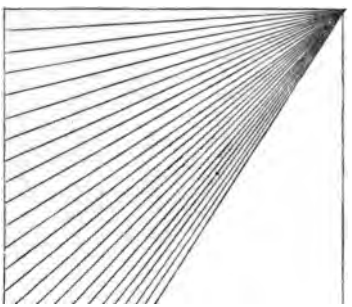
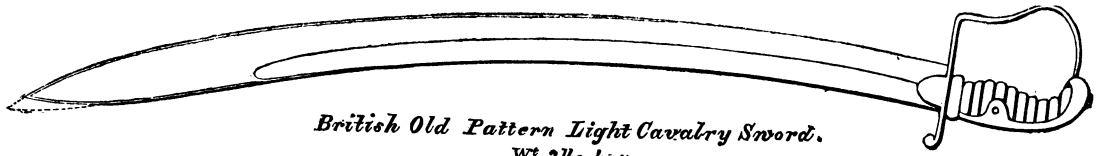


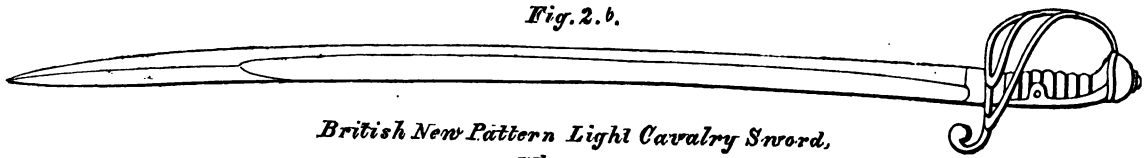
Fig. 4.





British Old Pattern Light Cavalry Sword.
Wt. 2lbs. 4oz.

Fig. 2. b.

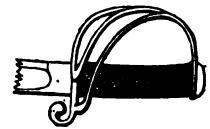


British New Pattern Light Cavalry Sword,
Wt. 2. lbs. 7 oz.

Fig. 7.

Turkish Scimitar. "Bala" Shape.

Fig. 2.c.



N P. Hilt

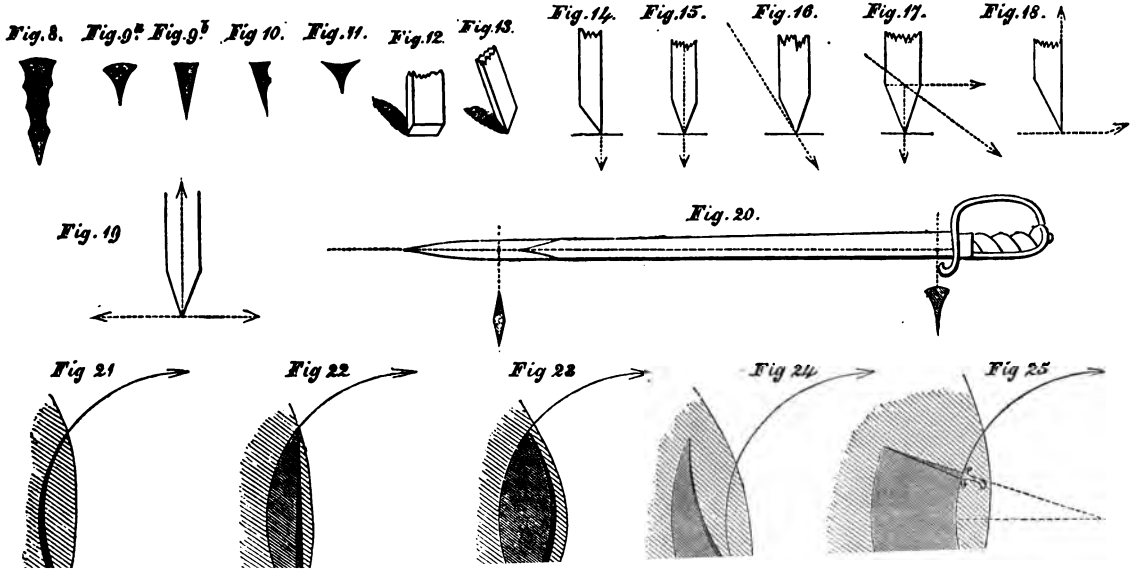
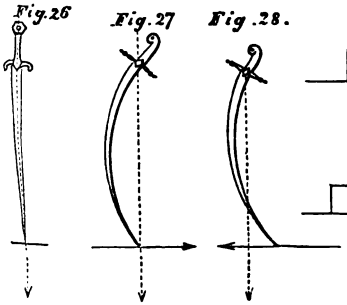
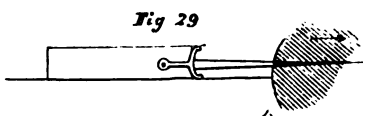
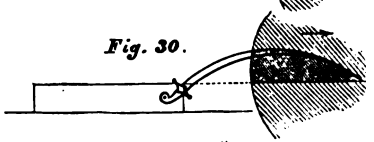


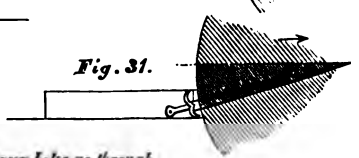
Fig. 8.
Fig. 9a
Fig. 9b
Fig 10.
Fig. 11.
Fig. 12
Fig. 13.
Fig. 14.
Fig. 15.
Fig. 16.
Fig. 17.
Fig. 18.
Fig. 19
Fig. 20.
Fig 21
Fig 22
Fig 23
Fig 24
Fig 25

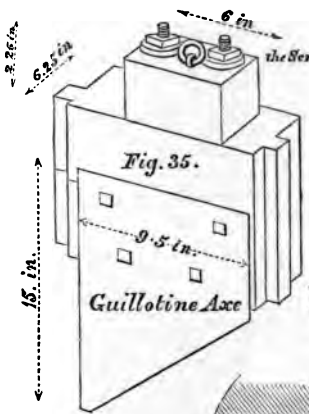
PLATE 4.

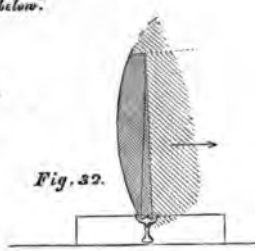












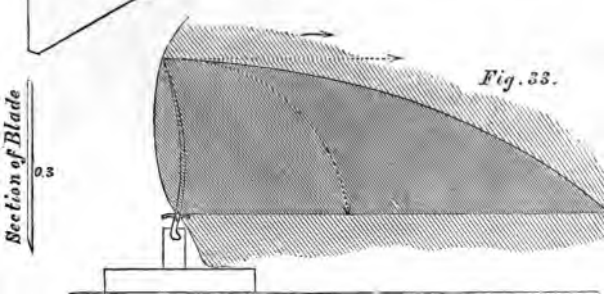
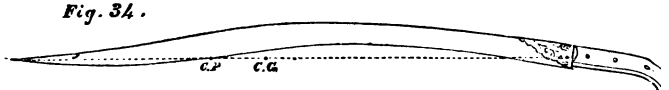


Fig. 34.



Yataghan in the Tower Armoury.

PLATE 5.

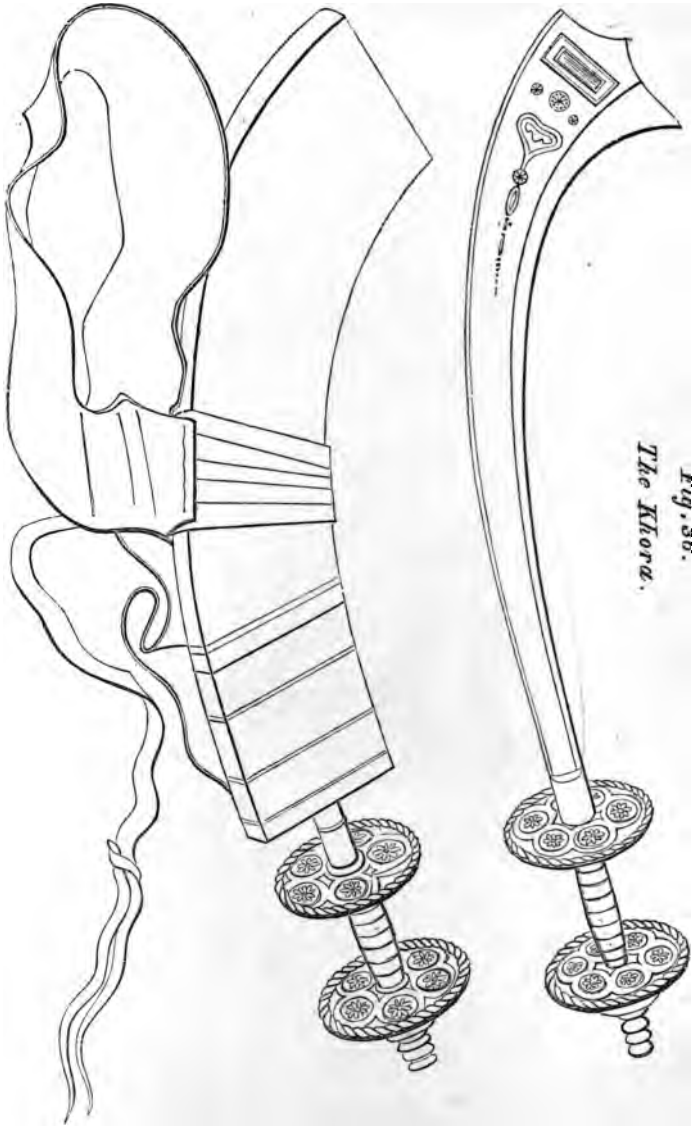


Fig. 30.
The Khora.

PLATE 6.

Fig. 37

The Kookhri.

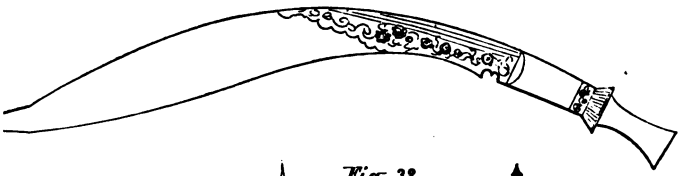


Fig. 38.

Fig. 39.

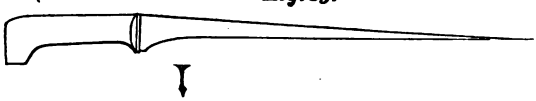


Fig. 40.

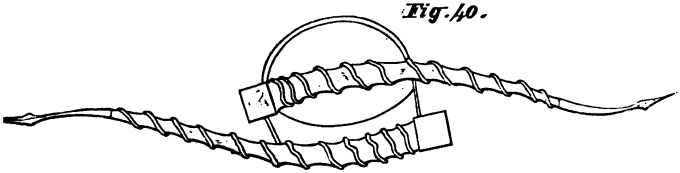


Fig. 41.

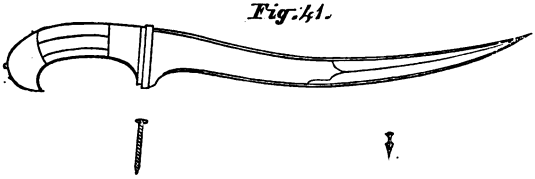


Fig. 42.

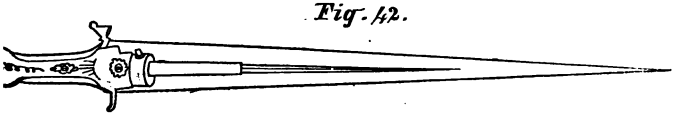


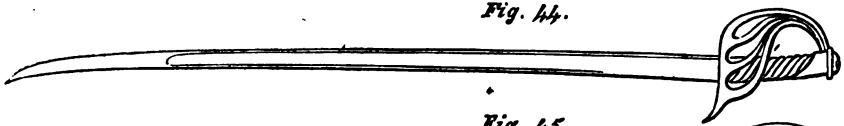
PLATE 7.

The Hindostani Tulwar.

Fig. 43 a

Fig. 43 b

Fig. 44.



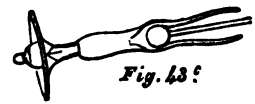


Fig. 43 c

Fig. 45.

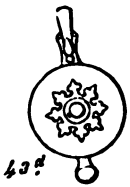


Fig. 43 d

Fig. 46

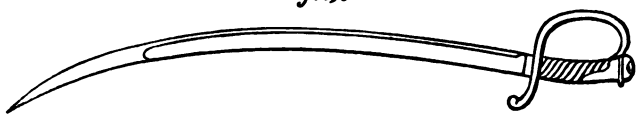


Fig. 47

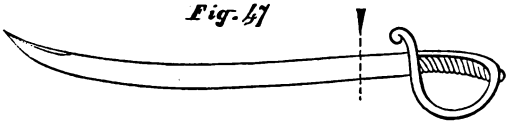


Fig. 48

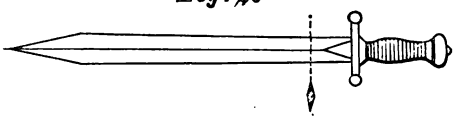


Fig. 49

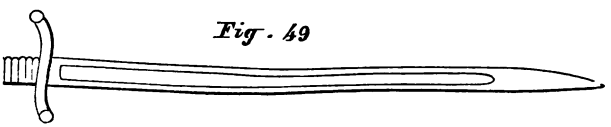


Fig. 50 1/10

Fig. 51.

m XI

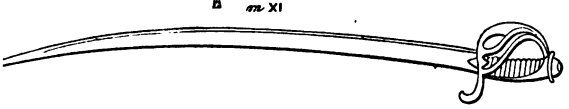


Fig. 52

m XIII

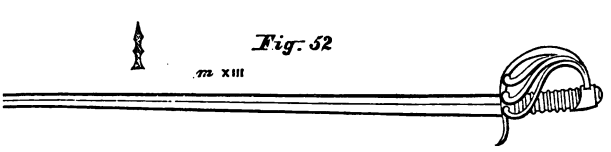
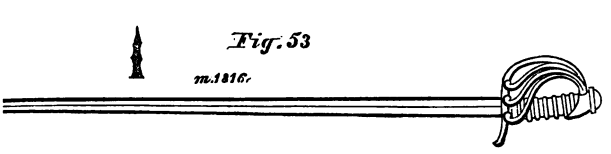


Fig. 53

m.1816.



TRANSLATOR'S PREFACE.

: original work, of which I offer a translation to
ıblic, was published at Strasburg in 1841, and
ıce become very scarce, being now out of print.
only after repeated efforts, during several years,
succeeded in procuring the copy I now possess,
is a second-hand one, having been presented,
ıears by an inscription in the handwriting of the
, to a friend. This copy, however, was not des-
o remain quietly in my possession, as it fell into
nds of the Rohilcund mutineers, who, not un-
ıding French, I presume, flung it out on the
Trunk Road, near Allyghur. Fortunately for
was taken to the magistrate of the district, and
ıns of an advertisement in a newspaper, it once
ame into my possession, and I was thus enabled
e this translation.

ıay be said to be "a heavy blow and great dis-
ement" to a man, who has resolved to translate
, to be met at the outset by an obstacle in the

shape of the very first words of the title-page—to that the languages into which it is to be rend does not contain words capable of succinctly g the meaning of those in the original. Such is the with the work in question; and, strange to say, th not the first time I have met with this rebuff in a cisely similar manner. The title in the origin "*Mémoire sur les Armes-blanches.*" The last words, connected by a hyphen, form a generic ter which we have no synonym: it includes *all por arms, other than fire-arms, defensive and offen made of steel or iron;* thus comprising swords o sorts, bayonets, daggers, boarding-axes, pikes, la &c., among offensive arms; and cuirasses of the h dragoon and sapper, as well as helmets of all nat &c., among defensive. What the French term i cates in two words, I have been compelled to tran by fifteen. Any person, then, I conceive, who w invent a word, or combination of words, and cau to be accepted by the military world, which w succinctly convey the meaning of this French t nical term, would make a most acceptable add to our essentially poor military terminology. I endeavoured to do so, and have failed signally, as many abler men to my knowledge. And lest any should consider the addition of such a term to military technical vocabulary a species of sacrileg *our language,* let me quote the words of an exce

authority on the subject.* Alluding to the introduction of new words into the English language, he says:—"I do not refer here to purely scientific terms; these, so long as they continue such, and do not pass beyond the threshold of the science, or sciences, for the use of which they were invented, being never heard on the lips, or employed in the writings, of any but cultivators of these sciences, have no right to be properly called words at all. They are a kind of short-hand of the science, or algebraic notation; and will not find a place in a rightly-constituted dictionary of the language, but rather in a technical dictionary apart by themselves." The new word, or combination of words, if even it be invented, to quote further from the same authority, should be formed "according to the analogy of formations which, in seemingly parallel cases, have been already allowed." As a further proof of the legitimacy of thus making a new word current, I may state that the Germans have literally translated "Armes-blanches" into "Blanken-waffen," and this term has been universally adopted by their military writers.

I have been induced to make and publish this translation, because I am not aware of the existence of any work on swords, &c., in the English language,

* The Very Reverend R. Chenevix Trench, Dean of Westminster, author of "English, Past and Present," and other admirable works on our anguages, at p. 68 of the book quoted.

save a diminutive pamphlet by Wilkinson, the sword-cutler; and because the original, recommended in the highest terms by Thiroux, a French writer on artillery of the first class, appeared to me to go to the bottom of the question with the most profound sagacity, combined with practical and scientific knowledge. That his readers, if such this translation of the author's work is destined to have, may endorse this opinion, is my most sincere wish.

The original work has no plates. I have endeavoured to supply what might be thought a defect, having made sketches, and copied plates of arms, &c., in various parts of the world for the purpose. I trust they may tend to elucidate the text. I have further added a few foot-notes as occasion seemed to require.

H. H. M.

AGRA,
Sept. 1859.

ERRATA.

—♦—

8 from bottom, for "*of* the prolongation" read "*on* the prolonga-

› 17, for "*Tabau,*" read "*Taban,*"
st three lines, for "*in* xi." "*in* xiii." "*in* 1816." read "*an* xi."
i." "*an* 1816."
2, for "*languages*" read "*language*"
› 14, for "if *even*" read "if *ever*"
› 4, for "*thumbs*" read "*thumb*"
› 25, for "Fig. 6" read "Fig. 5"—page 59, line 9, for "Figs. 35
read "Figs. 39 and 42," line 10, for "Fig. 37" read "Fig. 38"
)5, line 20, for "Fig. 58" read "Fig. 53"
› 21, "for gravity *on*" read "gravity *of*"
› 22, for "*cleans*" read "*cleaves*"
› 2 of note, for "*One* author" read "*Our* author"
› 2 of note, for "*Ensign*" read "*Major*"
› 11, for "*swing*" read "*sewing*"
›s 3 and 4, for "embodies combination of qualities such" read
lies such a combination of qualities"
2, page 48 lines 1 and 16, for "*edges*" read "*ridges*"—page 48 line
edge" read "*ridge*"
› 11, for "*Our* species" read "*One* species"
› 27, for "*lines*" read "*line*"—and page 75, line 26, for "*lines*
read "*line forms*"
› 3, for "*has* reversed" read "*be* reversed"
› 2, for "*latter*" read "*former*"
› 3, for "*systematical*" read "*symmetrical;*"
es 2 and 3, for "*make* with *the angle of* the back, an angle" read
with the back an angle"
› 1 of note, for "Major J. *Crovone*" read "Major J. *Govone,*"
2, and page 89 line 28, for "*muzzle*" read "*barrel*"
22, and page 80 line 15, for "*curvation*" read "*curvature*"
› 26, for "*arm*" read "*area*"
› 1, from "*of rest* of the blade" erase the words "*of rest*"
e 21, for "thickness as *those*" read "thickness as *that*"
› 18, for "ordinary *men*" read "ordinary *run*"
e 7 for "*Flessa*" read "*Flissa*"—line 11 for "*thus* they" read
they"
t line, for "*recorded;*" read "*reversed;*"
ıe 14 for "*this* point" read "*the* point"—line 15 for "*then* the
read "*thence* the blade,"

MEMOIR ON SWORDS.

PRELIMINARY.

CHAPTER I.

OBJECT OF THE WORK.

Being garrisoned at Strasburgh as an officer of lery, I employed myself in researches upon swords. ractised with them so as to be able to use them iently, and acquired sufficient dexterity in so g. The neighbourhood of Klingenthal enabled to make up, at my own charges, a great number of ds of different patterns, all of which I tried suc- ively. These labours were interrupted by the dition to Algiers, and by a sojourn of nine years frica. Having served in that country as a cavalry er, I always wore a sword of the pattern I propose doption, and found it a serviceable weapon. This oir gives the results to which these researches

I propose to examine the reasons which deter- the shape of swords, to collect them together in

the form of principles, and to apply these prin to the examination of the usual patterns; fin deduce therefrom a few new-pattern arms, wh submit to the lights of the general officers of ar and cavalry, to the end that these essays should i other officers to invent patterns susceptible of tion, if those which I propose are not approv Feeling certain that my ideas will be found sound and of useful application, I shall consid self fortunate if my labours conduce towards to the number of the many improvements lately duced in the various branches of the important se of the artillery and cavalry.

3. I am aware that the success of cavalry de more on the ability and courage of the men th the shape of their swords. It is reasonable to b however, that a good weapon adds to the soldier' fidence; at any rate, it may be interesting to lay the principles which enable us to appreciate the ties of any given arm; and, on the other han requisite qualities being given, to determine the of the blade that shall possess them.

CHAPTER II.

THE ELEMENTS OF THE QUESTION.

1. THE object of offensive steel arms is to p on the animal economy of an enemy serious i *such as shall* result in his death, or in puttin

rs de combat. The requisite depth of wound has, cording to time and place, been attained by striking

First—With a *surface*, more or less extensive, such with clubs, maces, mallets of arms.

Second—With a *line*, as with all cutting weapons: bres, axes, scythes, &c.

Third—With a *point*, as with all arms intended to used in thrusting: lances, poniards, bayonets.

Fourth—With arms which *penetrate*, impregnated h *poisonous* substances, as were, and are still, in in many savage nations.

The march of progressive improvement made in el weapons is characterised by a gradual diminution of the mark left by the body striking on the body ck, whether the former be a *surface*, a *line*, or a t—of the amount of exertion required to inflict a nd of the requisite depth—of the weight of the pons—of the muscular force necessary to wield n—and likewise by an increase of their actual iency.

. Contusive weapons appertain more particularly he barbarous ages, when the metals were but little wn, and when physical force was of more account n dexterity.

Poisoned arms, likewise, are only used by savage ions but little advanced in civilisation. Their arms made of wretched materials, such as hardwood, es, stones, &c.; they are ignorant of the method of ping them into the most judicious forms, and they only thus procure the means of inflicting serious ry; to them war is generally a series of single

combats, in which the combatant strikes with the desire of destroying a personal enemy, and with all the bitterness of savage irritation; while, on the other hand, war between civilised nations is carried on by masses, and, generally speaking, with coolness. It is remarkable that no ancient nation renowned for its military successes, used poisoned weapons. Nevertheless, the army which first employed these means before the invention of gunpowder, must have created a profound moral impression upon its enemies before coming to hand-to-hand combat. Poisoned, like contusive, weapons are in keeping with a state of civilisation in which a conquered enemy is scalped or eaten.

Cutting arms were and are still much used. They have attained a degree of perfection which enables them to produce the most extraordinary, not to say incredible, effects. One portion of the cavalry in Europe is exclusively armed with weapons of this nature. In France the effect of the point is more particularly relied on.

3. In nature we find the lower orders of creation armed in a manner almost analogous to ourselves thus:

First—The effect of the blow of a club may be compared to that inflicted by the head of a ram, the trunk of an elephant, the hoof of a horse, the fist of a man, the wings of certain birds, and the tails of a crocodile and of certain fish.

Second—The tusks of a wild boar appear to be the sole cutting arms given to animal creation; for the

igs of other creatures tear rather than cut, and seem be intended to penetrate first, and to hold on afterrds.

Third—The tusks of an elephant, the horn of a inoceros, those of a bull, the canine teeth of the nivora—their fangs, the quills of a porcupine, the uliar arms of the saw and sword fishes, are all inded for thrusting.

Fourth—Bees, scorpions, and venomous serpents ect poisonous matter into the wounds they inflict.

Fifth—There are some animals who fight by means projectiles: among other creatures, the ostrich.*

The offensive arms of the animal creation resemble se employed by the first men; they are generally tusive in their nature, or they give point, or emson. The cause of this similarity is that it is remely difficult to supply the place of the metals by er materials possessing the qualities requisite for ing instruments.

The tusks of the wild boar, which literally cut, do act from the centre to the point like our sabres, by penetration primarily and cutting subsequently; could not be much longer without prejudice to r strength.

The commonest arms are those intended for thrust- The carnivora, who live by making war on other als, use their incisor teeth to kill their prey, as ards are used in stabbing.

We shall have occasion to draw inferences from the

* When pursued he dashes stones at his pursuers with great violence.—r.—T.

form affected by the arms given by nature to the b creation, applicable to our own weapons.

4. Swords seem at first to have been intended thrusting, and at a later period for cutting, and with moderate efficiency. We shall see that these qualities are compatible in the same arm. We proceed to examine separately that which constit each of these qualities.

PART I.

OF ARMS USED FOR CUTTING.

CHAPTER I.

ICUSSION OF THE PRINCIPLES IN ARMS USED FOR CUTTING.

1. In making a cut, the sword is brought down h great velocity on the body struck; this velocity obtained by a species of rotatory motion, engen- ing a centrifugal force. The velocity of rotation s on the body cut into; the centrifugal force is nteracted by the resistance of the wrist, and bears n the little finger: in cutting with a sword, using ch force, the little finger sustains very great pres- e. In the Turkish scimitar (Figs. 1 and 7) the ion of the grip, whereon the little finger bears, is y wide; in the curved British sword (Fig. 2) it is derately so; and in ours, not only is this part very row and its angles quite sharp, but it has occasion- several most injurious ridges left thereon by way ornament. Further, most of our swords (Figs. 44, 46) hurt the little finger, and even excoriate it, if a be made with force, or if "moulinets"* be prac-

If a straight stick be grasped by the thumb and index-finger at their

tised with them. *The bearing of the little finger the grip should be wide and smooth:* this is a matte the most essential importance.

As to the line of direction of this part of the gri should vary according to the nature of sword exer in use: many swords, which are acknowledged tc well made, have the grip at this point inclined to general run and gradually sloping into it, so that actual bearing of the little finger is situate in rear of the junction of these two lines; others, ag have the bearing perpendicular to the grip. I h tried both the one and the other plan, and it seer to me that, if the first system were preferable for li swords intended exclusively for cutting, the secon more adapted for our swords, which are tolera heavy, and intended principally for thrusting.

2. A cut is effected by the combined motions of upper and fore arm, the wrist, and the sword in hand. If a series of cuts be made, in each of wh one of the above-named portions of the body be u separately, while the rest are kept rigid, and if marks successively produced by the sword be left thin wooden planks, we shall find that the cut du the wrist motion is the most effective; that when whole of the motions are made in combination, sword lies in a direct line with the fore arm, and i it often passes that line, and finally that the motio the sword in the hand has a most notable effect. things being in other respects identical, the greater

junction, and if it be whirled round and round continuously, the "moulinets."

amount of space traversed by the cutting edge in equal spaces of time, the greater will be its velocity and the more effective its action.

Hence we deduce these conclusions—

1*st*—The grip has all the more play the narrower it is crosswise—that is, in the direction of from back to edge of the blade, but more particularly at the points where it is held by the index and little finger, these two having the greatest effect on the lever acting inside the hand.

2*nd*—The grip should be smooth, so that friction may not check motion in the hand, and that no unevenness of surface may hurt it. It is more especially of great importance that nothing at the grip, nor at its side, should injure the index and little finger, as is the case in several patterns.

The grip of the Mameluke sabre (Figs. 1 and 7) is smooth, narrow in the direction of the width of the blade, and wide in a perpendicular direction thereto. The curved British sword (Fig. 2),* which, like the

* The author all through his work speaks of the old British Light Cavalry sword as an admirable weapon for cutting, and his judgment is remarkably confirmed by the following interesting extract from Captain Nolan's book on Cavalry :—

"When I was in India an engagement took place between a party of the Nizam's irregular horse, &c. . . . . My attention was drawn particularly to the Doctor's report of the killed and wounded, most of whom suffered by the sword, and in the column of remarks such entries as the following were numerous :—

" 'Arm cut from the shoulder.'

" 'Head severed.'

" 'Both hands cut off (apparently at one blow) above the wrists, in holding up the arms to protect the head.'

" 'Leg cut off above the knee, &c.'

. . . . . .

"And now fancy my astonishment!

above, is very well fashioned, has a grip which is narrow at both ends and bulges out in the centre; the bulge exerts no injurious influence.

3rd. The thumbs should not be placed on the back of the blade in striking with the edge, as laid down in the French regulations; for, under such circumstances, the motion in the hand and that of the wrist cannot have play. Among nations famed for the extraordinary effect produced in cutting, the system of sword-exercise is in accordance with this idea.

4th. Several other positions prescribed in the French regulations relative to the manner of using the edge should be modified. In the motion, "*à gauche sabres*" (left attack), for instance, the sword is carried to the right in the direction of the extended arm; a cut from this position cannot possibly be a powerful one. To produce a serious effect with a sword in this motion

"The sword-blades they had were chiefly old dragoon blades cast from our service. The men had remounted them after their own fashion. The hilt and handle, both of metal, small in the grip, rather flat, not round like ours when the edge seldom falls true; they all had an edge like a razor from heel to point, were worn in wooden scabbards, a short ring aling held them to the waistbelt, from which a strap passed through the hilt to a button in front, to keep the sword steady and prevent it flying out of the scabbard.

. . . . . .

"An old trooper of the Nizam's told me the old English broad blades were in great favour with them, when remounted and kept as above described, but as we wore them, they were good for nothing in *their* hands.

"I said, 'How do you strike with your swords to cut off men's limbs?'

"'Strike hard, sir!' said the old trooper.

"'Yes, of course; but how do you teach them to use their swords that particular way?" (*drawing it.*)

"'We never teach them any way, sir; a sharp sword will cut in any one's hand.'"

Pp. 110, 111, 112, "Cavalry: its History and Tactics," by Capt. L. E. Nolan. 2nd Edit. London: 1854.

the arm should not be extended, nor should the thumb be on the back of the grip; while the blade, instead of being in the prolongation of the fore-arm, should be thrown backwards forty-five degrees beyond the perpendicular and lie close to the shoulder: thus the cut will not only be animated with the velocity due to the arm, but further with that caused by the wrist making the point describe three-eighths of a circle in the same period of time—this being the result of the difference between the original and the proposed positions of the sword.

3. The edge, to act with full effect, should have the rest of the blade included in the plane it describes; in order that the momentum resulting from the velocity and the volume should actuate it. The breadth of the blade contributes towards keeping itself in this position; for the air has an effect upon it analogous to that of the wind upon a weathercock, the plane of which adjusts itself in a direction determined by the position of its pivot and the direction of the wind.

The hilt, when its centre of gravity is not in the plane of the blade, has, on the other hand, an opposite and injurious influence in the above respect. Thus in our cavalry swords the branches of the guard are placed on one side only, while the front branch is in the centre; they consequently tend to destroy the *àplomb* (equilibrium) of the cut, and to cause the blade at the moment it meets with resistance from the body struck, to turn the flat of the sword in the direction of the side branches.

Swords intended exclusively for cutting are

symmetrical, and have generally but one branch; Turkish sabre has no branches whatever. Sw intended for both thrusting and cutting appea require a defensive hilt. It is quite possible, ar seems desirable, that it should be made symmetr In many patterns it is so; but if one side of the l ought to be more guarded than the other, which be fairly admitted—as in the ordinary positio pointing with the wrist in tierce, it requires t more defended on the side exposed to the enemy on the opposite one—it is at least desirable to dimi the injurious influence of the want of equilibr by placing the front branch not immediately in centre, but on the opposite side; at the same making it stouter and heavier than the other bran In this manner we should apparently gain as reg an equal distribution of the weight of metal, whi the same time the hand would be better guarded have had several hilts made up of the pattern descri the advantages gained seem to entail no correspon disadvantages.

4. The sharper the edge, that is to say, the narr the base of the triangle by which it is formed proportion to the perpendicular let fall from the to the base, the greater is the faculty of penetratic

Many swords have a very fine edge; this is atte with the disadvantage of weakness. The adva of combining strength with an edge which cut though it were very sharp, has led to the blade l made more or less curved.

To account for the effect thus produced, le

e a blade (Fig. 3) whose cross section is trian-
that this blade strikes a body obliquely, and
e oblique mark left on the blade by the body
is double the height of the similar mark which
be left on the blade, by striking perpendicularly,
ı edge to back. In the former case the blade
have cut as though the triangle which forms the
ection of the edge had for its base, the constant
ty the thickness of the back, but a double
; or, in other words, as though the angle of the
were sensibly half less.

ı cut made with full velocity, the blade at the
ıt it comes in contact with the body struck
lie in the direction of the fore-arm; it strikes
rection nearly perpendicular to the prolongation
origin * of the blade. The greater the inclina-
: the part of the edge which strikes to that line,
eater will be the length of the mark left on the
by the wound.

he Mameluke scimitars, this inclination amounts
ty-five degrees; the length of the mark left is
ılly more than double the width of the blade, and
y be quintuple when the edge is slipped across
ject, as usual in producing delicate effects, such
tting a sheet of paper suspended by a thread.
the Turkish blade cuts as though it were from
to five times as sharp as it actually is.

tain wide-bladed swords and halberts have edges

* term "origin" of the blade or hilt is used throughout both the
and the translation in a mathematical sense; in the same manner
atises on the straight line or on curves, the "origin" of the one
other is *spoken of*. T.

serrated like a saw, that is to say with many t
inclined to the direction of the stroke at an ang
forty-five degrees; this facilitates penetration lik
curvature of the Turkish blade. But this form
of the edge being essentially weak was not, and c
not, be adapted to any but the very strongest
stoutest blades. The same may be said of the
or flame-shaped edge (Fig. 1),* which moreove
attended with the like quality.

In the British light cavalry sword (Fig. 2), w
is less curved than the Damascus blade, this effe
still tolerably apparent; it is nearly *nil* in our patt
which are but slightly curved. Of this we may
vince ourselves by examining and comparing the m
left on the blades by the object struck in our patte
in other swords of equal curvature but in the opp
direction, and in purely straight swords. We
account for this too by remarking, that if between
parallel lines (Fig. 4) we draw one at right angles,
further other lines, making small angles with the
pendicular, the differences of the lengths of the l
comprised between the two parallels is very trifl
while it increases vastly as the angle approaches fc
five degrees, and much more as it exceeds that an
thus practice and theory agree in this matter.

It is not necessary that the cutting edge should
inclined to the origin of the blade to produce the e
of a more acute edge; it is merely requisite to s

* As a specimen of a flame-shaped or wavy blade, I give a sket
Fig. 1, of a "Damascus Sabre, given by Yussuff Karaman Ali, Pas
Tripoli, to Captain W. H. Smyth, R.N., K.F.M.," No. 845 of the c
tion of arms in the United Service Museum, Scotland Yard.

direction of the force of the blow, by causing the ges to glide upon the object struck by a peculiar tion of the wrist from front to rear. This is ctised in the broadsword exercise, in which the batant endeavours to keep his point opposite his ersary's body as far as possible; this is termed awing." A sensible effect of velocity is thus ob- ned, without which penetration would have perhaps n impossible. The normal velocity in this cut, ich is almost tangential, is feeble; consequently the el has but a slight effect in compressing the flesh, ch merely sustains a feeble pressure in a normal ction. The edge in the cut acts as though it e from ten to fifteen times sharper. This style of is particularly applicable to cutting soft sub- nces; it is not so, on the other hand, with hard tances. For the latter a blow is required having t momentum, resulting from the velocity and the ght of the weapon.

The surgeon's bistouri and the table knife both cut sawing, as though they were from ten to fifteen es sharper than they actually are, varying within e limits according to the nature of the tangential ion given to them.

The Mameluke scimitar, owing to its curvature, s like a straight sword of equal length and thick- s, but of a breadth about four times as great, whose es would be four times as acute.

straight knife used with an alternate motion cuts ough, length and thickness remaining the same, idth were from ten to thirty times as great, and

consequently as though its edge were from ten thirty times as sharp.

Thus, when the edge is perpendicular to the stro it penetrates like a wedge having the same angl but when it is oblique to the direction of motion, penetrates as though the angle of the edge were m acute, and this effect increases with the obliquity.

This advantage may be obtained by making t blow in the ordinary direction, and with the us velocity, but having the edge oblique (Fig. 35),* or t edge being straight, by causing it to act with a sawi motion. The latter method adds much to the eff of the pressure, and to a blow made with small norm velocity, but it is by no means applicable to cutti through aught but soft substances.

To make a sword which shall act with an edge i clined to the direction of the blow, may be effected various ways. The blade may be straight in i general direction, the edge being cut saw-fashion, into a flame shape, or the edge of the blade may h a general inclination to the origin of the blade.

The effect is much increased by the curvature the blades, as in the Mameluke sabre; it is less, still tolerably apparent in highly curved Europ blades; and it is insignificant in those of sli curvature, as in the last French pattern.

* The guillotine is a case in point, and as few persons have seen a specimen or a drawing of this instrument, I append, at Fig. 5, a s of the "Axe of a Guillotine, cut down by the late Admiral Sc Guadaloupe in 1794, at the taking of the West India Islands. Royalists had already been decapitated by it." It is preserved in United Service Museum, Scotland Yard, and numbered 1593.

t is to be remarked that it is by an analogous effect
t pointed instruments endowed with a rotatory
ion penetrate under pressure—as for example,
ew-augers and corkscrews. The separation of the
es caused by the point is no longer the effect of a
ple cone, having an inclination in conformity with
lines of the sides of its generating angles; but
ner as though this angle, having the same base, had
a side the curved line described by one of the
remities of the base, or as though this angle were
y much smaller.

This further explains one of the advantages of the
e; since a ball endowed with a rotatory motion
aves more easily through the air, and more especially
ough the object struck: this being tantamount to
ring a greater velocity at the moment of impact;
l more than this indeed, for with equal velocities,
penetration would exceed that of a musket bullet.*

5. With a sling a bullet† may be thrown with very
siderable velocity, approaching to that of a musket

This boring action is treated as absurd by Robuis, at p. 334 of his
us work "New Principles of Gunnery," for he says, "the rifles
oves) of the piece diminish the velocity of the bullet, and consequently
owers of penetration." The original French work having been pub-
d in 1841, there can hardly be question of a conical bullet. Nor,
rding to my ideas, can the case of a fluid, like the air, be deemed
logous to a fibrous substance, like wood or flesh.

Bullets made of lead, called in Greek *molybdides* and in Latin *glandes*,
of a form between an acorn and an almond, were cast in moulds
retius and Ovid), to be thrown from slings. They have been
d on the plains of Marathon and in other parts of Greece, and are
rkable for the inscriptions and devices which they exhibit, such as
derbolts, the names of persons, and the word "DEXAI," meaning
ke this." I have measured such a gland; it was 1·18″ in length,
″ in breadth, and 0·62″ in thickness, and weighed 686 grains, about
reight of our old Minié bullet. T.

bullet fired with a small charge. This velocity is communicated to the projectile by a motion of rotation of the hand and of the lanyards of the sling; the lanyards are of about the same length as a sword. We may imagine consequently, that the edge of a sword is capable of acquiring very great velocity, and one almost analogous to the sling; but for this purpose the weapon must be very light; we may likewise observe that lightness is one of the qualities of the swords known for their powers of cutting well. To this end the advantage of a protective hilt is sacrificed in the Mameluke sabres, and the British, Prussian, and Hungarian curved swords have but a single branch to the hilt.

In cutting with full force, the velocity of the hilt of the sword is much less than that of the point of the blade, precisely in the same manner as that of the wrist whirling a sling, and of the bullet which it projects. Several foreign regulations insist on the arm and fore-arm being almost stationary in giving certain cuts.

Some weapons, such as battle-axes, two-handed swords, act by means of great volume and small velocity. If, on the one hand, they produce great effect, on the other, they are heavy, difficult to handle, and their system of fence is but little favourable to vivacity of attack and defence. The nations most famed for the use of the sword are armed with weapons so light, that the edge attains a velocity which may be compared to that of certain projectiles. The *momentum* in both cases is the same, only that in the

latter, it is composed of a light weight multiplied into great velocity. The velocity of the point of a sword in making a cut which produces a great effect with the edge, may be estimated perhaps at about 50 metres (164 feet) per second.

6. In the cut, a sword should be considered in the light of a projectile, of which the portion in the neighbourhood of the point has a much greater velocity than the hilt. The hand gives it the impulse, and does not act by pressing the sword on the body to be penetrated at the moment of impact.

For the velocity to be a maximum, the point of the blade, after having traversed a large space, should be in the line of prolongation of the fore-arm.

By experiment we shall find that the portion of the blade with which the object should be struck, depends on the shape of the sword. In straight patterns it is situate at a point about two decimetres (eight inches) from the point of the blade.

At the moment of impact, the whole of the sword moves with an impulse perpendicular to the object struck, but with a velocity diminishing from point to hilt. We will examine how the different parts of the sword act.

Let us suppose (Fig. 6) the edge to strike at a distance of two decimetres (eight inches) from the point, there will be three parts of the sword acting differently, namely, the part between the spot which strikes and the point; again, the part on the other side of this spot, having an equal momentum with the former and being of about equal length; and finally,

the rest of the sword between the end of the seco part and that of the hilt.

The two first parts form a whole, the impulse which acts *in equilibrio* on the point struck: let call this whole A, the length of which is about fo decimetres (sixteen inches) from the point.

The remaining portion of the sword will act agreeab to the doctrine of the decomposition of forces: we w call it R.

The examination of the effects produced by A and is most important: we shall make some *approxima calculations* in this matter.

Let us admit, what is very near the truth, that weighs one-fourth of the total weight, P, of the swor and consequently one-third of the weight of R; th the velocity of the centre of gravity of A is fifty metr per second, and five times greater than that of th centre of gravity of R. The weights will be

$$\frac{P}{4} \text{ for A.}$$

$$\frac{3P}{4} \text{ for R.}$$

The velocities of the centres of gravity will be

50 metres for A.
10 metres for R.

The momenta (the weight into the velocity) will be represented—

$$\text{for A, by } \frac{P}{4} \times 50 \text{ or } P \times 12{\cdot}5 ;$$

$$\text{for R, by } \frac{3P}{4} \times 10 \text{ or } P \times 7{\cdot}5.$$

That is to say, that the momentum of A is to that of R in the ratio of 125 to 75, or as 5 to 3.

The momentum of A will be entirely applied to the y struck at its centre of gravity: it is not so, how- r, with R.

f, at the moment of impact (Fig. 5 and 6), the sword e not restrained by the hand, the part R would ow its impulse, and would tend to turn round the nt struck, thus adding little force to the stroke. ; if the wrist become a fulcrum, the part R will act a lever, the fulcrum being at the wrist, the power which will be the momentum acting at the centre of rity, and the resistance is at the point struck, that o say, at the centre of gravity of A. The force, ed at A, acting in the opposite direction, which ld keep the impulse of R *in equilibrio*, or, in other ds, the effect of R at that point, will be therefore he momentum of R in the inverse ratio of the dis- es of the centres of gravity of R and A to the centre he hilt, that is to say, in most swords nearly as 1:4.

Thus, not only is the momentum of A to that of R he ratio of five to three, but further, the effect of pon the point struck is only represented by one- th of its momentum. We will calculate the ratio hese effects.

The effect of A is represented by the momentum × 12·5 the whole of which acts fully on the object ick.

The effect of R is one-fourth of the momentum × 7·5 or P × 1·89.

The ratio of the two effects is thus—

$$\frac{P \times 12{\cdot}5}{P \times 1{\cdot}89} \text{ or } \frac{12{\cdot}5}{1{\cdot}89} \text{ or } 6{\cdot}6.$$

A produces consequently nearly sevenfold the used effect of R.

Experiment confirms this train of reasoning. Thus first, if the part A be joined to the part R by a hinge a cut may be made almost as well as with the entire sword: second, if a sword be placed vertically in *equilibrio*, point upwards, and that the part A be struck with a stick, as though to cut the latter through, the sword will be thrown backwards, the part A with considerable velocity and the hilt much more slowly. A sort of motion of rotation round the latter as a centre takes place; third, in the axe, the metal head is the part A, R is the handle, whose weight is only just sufficient that the material may be of adequate strength. Maces and clubs are constructed on this principle.

The chief action of the sword is thus due to the last four decimetres (sixteen inches) of the blade next the point. The part A should be as heavy and be endowed with as great velocity as is possible. The rest, R, of the sword has a much inferior effect.

The necessary liveliness of the motions of attack and defence require that the weight of the sword should not exceed certain limits. On the other hand, a soldier requires a sword to be what is termed *well balanced*, that is to say, that there should be a certain relation between the weights of the blade and hilt, such that the whole weapon should not be too heavy near the point, which would be inconvenient, nor too light, which would not admit of its inflicting a powerful blow. The centre of gravity of the sword should be at a distance from the hilt varying according to the pattern

ich experiment will easily determine for each ttern.

To give a sword its whole power of cutting without ering either its weight or the position of its centre gravity, the weight may be increased at each end d decreased in the centre, and to effect this, first the rt A should be made heavy; second, the rest of the ord should be lightened as much as possible; third, e hilt should be made lighter; for instance, it might made of steel, which will give the same amount of ength with much less weight; fourth, the pummel uld be weighted. A sword thus made would be ht, well balanced, and have great power of cutting.

It is to be remarked, that to move the sword in the nd, we must cause the index and little finger to act cessively as fulcrum and power to re-act on the hilt on the sword generally, as on a lever, the resist- e being the whole weight applied at the centre of vity. If the distribution of the weight of the rious parts be altered without changing the position the centre of gravity on the total weight, the re- tance and its point of application will remain the ne, and the sword will be equally well-balanced after alteration in the distribution, as previous to it. e must admit, then, that the alterations above recom- nded are not to the prejudice of the facility of ndling the sword. We may observe further, that ugh the sword be lightened, the amount of force uired to move it in the hand may remain the same hough the arm of the lever be lengthened, that is to y, that *cæteris paribus*, the lighter the sword the

further its centre of gravity may be from the h without prejudice to the balance of the sword.

In cutting with a straight sword, the point having much velocity as possible, the edge impinges on t object in a normal direction, and the hand may act two ways:

First—If it be checked suddenly, the part R cont butes its decomposed forces to the stroke, reduced, we have seen, to one-fourth of the momentum.

Second—If the hand be not checked, but prolong t motion, it produces two effects: the first is to gi the blow a certain additional amount of force, whi must be still further much reduced from that abo calculated, as the fulcrum from which the forces a decomposed no longer exists; the second is due the fact that the prolongation of the motion of t hand causes the edge to slip over the point struck, a gives it a greater faculty of penetration by making cut as though it were much sharper.

Both methods of cutting are in use, and may employed according to the pattern of sword, its w city, and the nature of the object to be cut. The f system gives the more powerful blow, and the last necessary in producing certain delicate effects. T first is prescribed in the German cavalry sword-ex cise; we may add that it is that which should generally practised, and that the second can only be service in exceptional cases, which are more curi than useful as applied to military affairs.

In the Mameluke sabre, the part A is much lon *than in* straight swords, owing to its curvature;

ends as far as two-thirds of the whole length of the de; the centre of gravity of the part R is much arer the point than in our patterns, in consequence the lightness of the hilt, it re-acts with greater force the stroke, because it is situate nearer the point ick, and because its action tends, in consequence of curve, to give the part A a sawing motion. The tness of the scimitar admits of the part A being de heavy; further, this sword acts with an immense ount of effective momentum.

The curved British sword is very thin, but very ad at the part A, which, in conjunction with a conrable curvature, gives this weapon great capacity cutting.

Our swords are not heavy enough at the part A; hence y strike with little percussive force, and cut badly.

In the pattern which I propose, the blade, between nd the hilt, is as narrow as possible. The hilt ng made of steel, is light; the part A is broad and k. This sword is well balanced, and with equal ght has more percussive force.

By making the edge narrower and more obtuse been the part A and the hilt, the blade is weakened. he action of the sword were due to the force of the d pressing it on the object, this arrangement would of prejudicial importance; but the case is not so. part R is not intended for cutting, but serves her more nor less than the purpose of a handle to the part A both velocity and direction; the great ity is at the part A; it is here that swords break npact; the part R is much less likely to be in

jured, because in that part the velocity is less and effect of impact on the blade less sensible, as it acts by decomposition of force.

7. The fineness of the edge has very great influ upon the effect produced by the stroke; it is as ne sary to the good effect of the sword as resin is to of the violin bow. We have seen how the penetra power of the blade may be increased, and the s effect produced as though the edge were much sha —by curving the blade, or by a sawing stroke. fineness of the edge gains in its effect in the proportion.

The fineness of the edge depends upon the mat of which the sword is made. The first cutting arms made of very hard wood, or of bones or stones. In tombs of ancient warriors are found stone-arms in war: the edge of all these arms is tolerably ob Bronze and iron were far inferior to steel for this pose. Finally, the selection and manufacture of for the purpose of making well-cutting sword-bl constitutes a special trade of great importance to efficiency of this weapon. The stuff, without b brittle, should be sufficiently hard to take an which should be at once very fine and able to re blow. It is this latter quality which constitutes of the great merits of Eastern blades. The edg be ground very fine, and it will retain its sharp much better than if made of more ordinary As it is absolutely requisite that the edge shou capable of withstanding a blow, the nature of *material* must determine its angle.

Our French swords have been much improved lat-
ly, as regards both the stuff and its temper; but
ey have one great fault which may very easily be
oided: they get soon blunted. The best-sharpened
ord, if it is drawn out of the scabbard and re-
rned three or four times, has but a dull edge,
cause it rubs in these motions against the metal of
e scabbard, especially at its mouth. As the fineness
edge of the sword is an essential condition to effi-
ncy in cutting, it seems to be imperatively necessary
have battens in the scabbard which shall protect the
ge, preserving it from every species of shock or
trition against steel, in drawing and returning, and
s not only inside the scabbard but more especially
its mouth.

9. Bodies which are intended to traverse resisting
diums, affect peculiar forms having a certain analogy
tween each other; these are dependent upon the
ocity, volume, and surface of the penetrating body,
well as upon the nature of that penetrated. In
neral terms, these forms have either a point or an
ge which cleans the body to be penetrated, a swell
maximum thickness of which has a variable posi-
n as regards the whole length of the body, and an
likewise terminating in a point or edge; besides
rved surfaces connecting these three portions.
ch are the forms of fish intended to move through
water, of birds through the air, of the submerged
t of water-fowls, as well as of the sections of ships
boats in the like situation. In no case is the
ost part situate at the end opposite to that whic

forces the passage; on the contrary, it is inva
in the other half.

The greater the velocity of penetration the
does the length of the body increase in prop
to its width, and the more, likewise, does the ex
width approach the part which penetrates.

Generally speaking, fish are from four to five
the length of their greatest depth, and are a
same time comparatively narrow; their maxi
depth and thickness are ordinarily situate at
one-fourth or one-third of their length from the
They cleave the water in the direction of
depth, by two inclined curves, which facilitate
tration in the same manner as the curve of a s
acting as though the depth were less than it actua

The plough-share cleaves the earth and throw
sod to one side; to effect this, the plough-share
one part which cuts vertically, a second which
horizontally, and a third which displaces the
cut and throws it out of the furrow. The latt
not flat like the face of a wedge; it is curvil
in form, after the same fashion and with the
object as is the right side of the submerged po
of the bow of a boat.

Judiciously made arrows have a swell in the s
the latter, instead of being cylindrical, increase
thickness from the point to about one-third of
length, and thence diminishes to the end.

There would be, doubtless, less eddy cause
the piers of bridges, and less action of the w
thereon, if their horizontal section, instead of b

ectangle rounded at both ends, were shaped more
that appropriate to the submerged part of a boat
ting through the water at the same velocity as
t of the current.

[f Congreve rockets were shaped agreeably to this
a, they would meet with less resistance from the
. I am not aware whether there may not be
er considerations opposed to the adoption of this
n.

The shape of a bullet or of a round-shot is not
t best adapted for penetrating the air and the
ct fired at; but it is necessitated by other cogent
ons. But for these, projectiles ought to cleave
air by a point; their thickness should then in-
se up to a certain distance, whence they should
e away until they ended in another point. They
ld thus lose less velocity from the resistance of the
and with equal velocities would penetrate deeper
the object struck.

think that in certain cases rifles might carry pro-
iles of the above-described form. We know that
llet projected by an arm of this nature moves
the part struck by the ramrod invariably forwards
ough the whole of the trajectory. If a Tyrolese
e be loaded and the ball afterwards extracted, we
ll find on examination that it is still spherical
the side next the powder—that it has become
indrical and marked with a few grooves at the part
ich was in contact with the sides of the bore—and
it is flattened on the side struck by the ramrod.
is shape is but little adapted for penetration, and it

consequently as though its edge were from ten thirty times as sharp.

Thus, when the edge is perpendicular to the stro it penetrates like a wedge having the same angl but when it is oblique to the direction of motion penetrates as though the angle of the edge were m acute, and this effect increases with the obliquity.

This advantage may be obtained by making blow in the ordinary direction, and with the us velocity, but having the edge oblique (Fig. 35),* or edge being straight, by causing it to act with a saw motion. The latter method adds much to the ef of the pressure, and to a blow made with small nor velocity, but it is by no means applicable to cutt through aught but soft substances.

To make a sword which shall act with an edge clined to the direction of the blow, may be effected various ways. The blade may be straight in general direction, the edge being cut saw-fashion into a flame shape, or the edge of the blade may h a general inclination to the origin of the blade.

The effect is much increased by the curvatur the blades, as in the Mameluke sabre; it is less, still tolerably apparent in highly curved Euro blades; and it is insignificant in those of sli curvature, as in the last French pattern.

* The guillotine is a case in point, and as few persons have seen a specimen or a drawing of this instrument, I append, at Fig. 5, a s of the "Axe of a Guillotine, cut down by the late Admiral Sc Guadaloupe in 1794, at the taking of the West India Islands. Royalists had already been decapitated by it." It is preserved i *United Service* Museum, Scotland Yard, and numbered 1593.

It is to be remarked that it is by an analogous effect ıat pointed instruments endowed with a rotatory ıotion penetrate under pressure—as for example, :rew-augers and corkscrews. The separation of the ɔres caused by the point is no longer the effect of a mple cone, having an inclination in conformity with ıe lines of the sides of its generating angles; but ther as though this angle, having the same base, had r a side the curved line described by one of the tremities of the base, or as though this angle were ry much smaller.

This further explains one of the advantages of the le; since a ball endowed with a rotatory motion aves more easily through the air, and more especially rough the object struck: this being tantamount to ving a greater velocity at the moment of impact; d more than this indeed, for with equal velocities, penetration would exceed that of a musket bullet.*

5. With a sling a bullet† may be thrown with very nsiderable velocity, approaching to that of a musket

This boring action is treated as absurd by Robuis, at p. 334 of his ous work "New Principles of Gunnery," for he says, "the rifles oves) of the piece diminish the velocity of the bullet, and consequently powers of penetration." The original French work having been pub-ed in 1841, there can hardly be question of a conical bullet. Nor, rding to my ideas, can the case of a fluid, like the air, be deemed logous to a fibrous substance, like wood or flesh.

† Bullets made of lead, called in Greek *molybdides* and in Latin *glandes*, of a form between an acorn and an almond, were cast in moulds retius and Ovid), to be thrown from slings. They have been d on the plains of Marathon and in other parts of Greece, and are rkable for the inscriptions and devices which they exhibit, such as derbolts, the names of persons, and the word "DEXAI," meaning ke this." I have measured such a gland; it was 1·18″ in length, ″ in breadth, and 0·62″ in thickness, and weighed 686 grains, about weight of our old Minié bullet. T.

The above effects are identical with those obtain by discharging an air-gun containing a great quant of compressed air, but without a bullet, against t same objects; if the air-gun be discharged against t flesh at a distance of one centimetre (0·39 inch) brings blood. A round-shot moving with great ve city, and passing very close to a man, should cause very dangerous shock, the effect of which would i crease with the calibre.

If a musket be discharged so that the bullet stri the flat of a book, the projectile acts by tearing, if

moment of its passage. Although the experiments instituted in 1843 a 1844 in the Arsenal of Washington, by Ensign Mordecai, proved that the distance of 48 feet the gases emanating from the powder have no e upon the ballistic pendulum; a second screen was placed before the ot at a distance of five metres (16 feet) from the apparatus, in order to prot it, if necessary, from the action of these gases. A 40 lb. howitzer (7 inches calibre) was then placed at a distance of 14 metres (46 feet) fr the first screen, the charge of powder being 4 lb.; the velocity of t projectile at that distance was equal to that of a bomb-shell projected w a 7 lb. charge—viz., 956 feet per second. The results obtained showed 1, that at a distance of three inches, the piston remained immoveable; that even when the projectile broke off a part of the wooden frame su porting the iron cylinder, the piston gave no indication of motion; 3, b that if the projectile just grazed the surface of the piston, a recoil of tw inches was obtained; 4, if, on the other hand, a fragment of the fra hit the cylinder, the piston, instead of moving backwards, would mo forwards about 3½ lines; 5, if the cylinder, instead of being placed paral to the screens, was placed obliquely, a recoil would take place of from one-quarter to one-half of an inch. Hence M. Pélikan concludes that since th piston required a force of 1½lb. in order to be moved one inch, and th wind of a cannon-ball can never be expected to exercise such a force, th passage of a projectile close to a living subject will only produce an insignificant effect, which cannot amount to a contusion."—Extract from th *Times* newspaper.

The conclusion come to by the experimenter is doubtless justified, and, so far as it goes, is perfectly satisfactory; but it would have been desirable had the description been a little more lucid as to the position of the cylinders and piston in each case, and that the piece of ordnance had been a lon gun giving a velocity of 1600 feet per second. T.

does not pass through it; but if its velocity be sufficient to carry it through, it clears a passage: the orifice is of a diameter equal to the calibre of the bullet, while the exit is from about twice to thrice that diameter; because the portions carried forward by the bullet are driven with great velocity, and thus become projectiles themselves: so that at the exit the effect is more than double—due to the bullet and the parts of the object carried before it.

It is remarkable that with high velocities soft substances and even liquids can pierce through hard bodies; thus, with wax, tallow, grease, or water, a board may be traversed by firing them from a musket from a short distance;—these experiments I have myself made. Penetration, in such case, takes place, because there is a certain volume combined with velocity and adequate condensation. But when the distance is much increased, these bodies no longer penetrate, by default of velocity and more particularly in consequence of diffusion, water being reduced to spray. Further, certain sportsmen load their guns with water instead of dust-shot, so as to kill birds without injuring their plumage.

In cutting a branch off a tree by a very swift blow of a sword, the portion so cut off is endowed with a certain velocity, which usually carries it to the distance of a metre (3·3 feet). The cause and effect in this case are identical with the above.

A round-shot traversing certain sorts of timber, if the velocity be high, makes a passage for itself without carrying away the piece. After the shot has passed,

there is no hole in the timber. The fibres of the wood separate, and then close in again.

In this last case the effect approaches closely to that which takes place in striking with cutting weapons; the velocity causes the edge to penetrate; the blade enters the wound by thrusting aside the parts divided, while these again close in; if the blade be in the shape of a wedge—if its greatest thickness be at the back—the divided parts, in closing in again, press against the blade and diminish the amount of penetration. If, on the other hand, the blade be shaped so that its thickness diminishes from the neighbourhood of the cutting edge to the back, and that this edge, on coming in contact with the object, be sufficiently sharp to produce adequate incision; and again—if, in the combination of the two motions, the penetration of the sword and the resistance of the parts, the latter do not take place until the blade has passed, the result should be that there would be no pressure or friction exerted on the blade, excepting in the part near the edge where it cannot be avoided; consequently, the amount of penetration would be greater with a blade so shaped than with a wedge-shaped blade.

The blow of a man acts by contusion or laceration; the edge of a sword, by incision only. The point acts by incision and separation. The vertex of the angle having penetrated, the edges, if they be sharp, divide the substance by incision, while the thickness of the side faces acts by separation. If the point be blunt at both edges, it penetrates by separation.

Some much-improved patterns of Oriental sabres

s formed in a manner which seems to be the appli-
ion of the above remarks. The greatest thickness
the blade is not at the back, but about mid-way
one-third way from the edge, whence it gradu-
y diminishes towards the back.* There are some
r European swords (Fig. 7) which already cut well,
sceptible of improvement in the above manner.

The principle admits, further, of application to arms
ended for pointing. The edges of the metal, con-
ting the point with the back and cutting-edge,
uld not form abrupt angles at the points of junc-
n; it is evident, further, that they should not be in
e same straight line; these edges should, conse-
ently, form curves commencing at the point and
ning away into the lines of the back and cutting-
ge. Experiment, indeed, proves, in trying swords of
h shapes, that the latter penetrate with by far the
ter facility.

. The object of the sword-knot is to prevent the
ord from dropping completely, in the case of its
ng knocked out of the hand. It is easy to compass

* The Translator saw a sword, evidently of the pattern alluded to, in
key, in 1853. A sketch of it is given at Fig. 7. The owner, a
kish officer, valued it at 7000 piastres (about £50). He said it
s of Baghdad manufacture, that the steel was of the quality termed
aban," and that its shape was called "Bala." It certainly was the
iest weapon ever the Translator held; its power of cutting was
ently enormous, and it had but one trifling disadvantage, namely, the
sterous size and shape of the scabbard, the back of which was open
m to the first ring, about three inches. In the United Service Museum,
land Yard, London, may be found two specimens of this sort of sabre,
vastly inferior in finish and value to the one above-described: viz.,
os. 810 and 811—Turkish Pirate Sabres, presented by Lieut. G. W.
erts, R.A." The length of the blade, measured along the chord of its
re, was 27 inches.

this object, without injuring the capacity of the swor for cutting; this cannot be said of our sword-knot 1st. It is too stiff, thick, and heavy, and has too muc swing in consequence of the weight of the end; it i inconvenient, and but little used; the trooper prefer a handkerchief rolled up, which weighs little, and i further, supple and convenient. 2nd. It is fastene to the hilt at the spot where the little finger bears, and seriously impedes its action.

In the Mameluke scimitar, the sword-knot is mad of silk; it is very light and thin, and is attached to the sword by being passed through a hole bored in the hilt in a direction perpendicular to the flat of the blade, and in the centre of the rounded part whereon the little fingers bears.* The object is thus attained without being attended with any injurious effect.

Our sword-knot should be made of silk or goat's hair; it should be about three millimetres (0·12 inch) in thickness; it should, further, have a light sliding-loop, and the end should be a simple knot without an acorn; nor should it be fastened to the main branch, but to the next one—by which arrangement it would be impossible for it to interfere with the bearing of the little finger. I look upon this matter as by no means unimportant to the efficiency of the cut.

10. In former days swords were worn horizontally, and this is still the custom among certain nations. To hang thus, it is requisite to have two billets which will keep the sheath in that position, being attached

* Vide Fig. 1, for the Turkish sword-knot and the manner of attaching it to the hilt.

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for in such a case it would hang hilt downward: sword would come out of the scabbard and fall t ground. 7th. The point where the long billet is ened to the waist-belt is the cause of grievous i venience in such corps as wear the belt over the this point should be placed between the two v buttons behind; the thickness of a man's waist v according to his condition and the clothes he has the position of the short billet at the left side is riable; if, then, the long billet be sewed on the v belt, it would be necessary to shift the swing when the circumference of the man's waist altered, in c that the long billet might still be between the buttons: to avoid this, it has become necessar attach a strap to the lower side of the waist-belt s which the loop of the long billet may run.

To recapitulate: the long billet is a useless we a troublesome bit of gear, hurtful and sometimes gerous. It seems to be only rational that it, tog with its band and ring on the scabbard, shoul abolished.

CHAPTER II.

RECAPITULATION OF THE PRINCIPLES INVOLVED ARMS USED FOR CUTTING.

THE peculiar conditions which are involved in fact of a sword cutting will seem to be the followin

First—That part of the hilt whereon the little fi bears should be wide and smooth.

Second—The grip should be smooth, and not

l be allowed to impede the action of the index ttle fingers.

rd—The grip should be as narrow as possible in rection of from back to edge of the blade, especi- here it is grasped by the index and little fingers.

rth—In cutting, the thumb should not be placed back of the grip.

h—If the guard of the hilt be not symmetrical, in branch should be stout, and placed, not in the , but on the side opposite to the other two.

h—The hilt should be light, and consequently it be well if it were made of iron or steel; the el should be slightly loaded with metal.

nth—The triangle which forms the edge should reased in height in that part of the blade which in contact with the object.

th—The curvature of the blade has the effect ing the sword a finer edge. This effect is very d in the Mameluke sabre; it is imperceptible in y curved blades. The same effect is attained by me-shaped blade, by a serrated edge, by sliding ge on the wound, termed "sawing."

th—The velocity has a great effect on the stroke, nsequently the same may be said of the lightness sword.

th—The lighter the sword the further may the of gravity be placed from the hilt without ring the balance.

enth—The last four decimetres (sixteen inches), ie point is the part which acts in cutting, and h more effective on impact with the object than

the rest of the arm. Unless the blade have a pecul power owing to curvature, this portion of it should thick for the sword to have great percussive force.

Twelfth—For a straight sword to have great perc sive force, and to be at the same time light and w balanced, the last four decimetres (sixteen inches) n the point must be thick; the remainder of the bl should be light, and have its centre of gravity towa the pummel, which, consequently, should be slight loaded.

Thirteenth—The fineness of the cutting-edge is the greatest importance for a sword to cut well. Th steel must be well tempered, it must take a very fi edge, and be at the same time sufficiently strong resist a blow. The scabbard should be so made th it shall not dull a well-sharpened edge; it should consequently lined with wooden battens reaching up its mouth.

Fourteenth—The greatest thickness of blade in t part intended for cutting should not be at the ba but between it and the cutting-edge, at a distan dependent upon the velocity of the stroke. This i provement is more applicable to swords which a specially intended for cutting.

Fifteenth—The sword-knot should be light, supp and without a big or heavy acorn end; it should fastened to the middle branch of the hilt, so as not incommode the little finger. It should be made eit of silk or goat's hair, instead of leather.

Sixteenth—The long billet of the sword-belt, as well *the band and ring* on the scabbard, should be abolish

CHAPTER III.

AMINATION OF THE ACTION OF CERTAIN ARMS AND TOOLS USED FOR CUTTING.

FROM what has been above stated, we may be able to preciate the merits and demerits of certain arms and ols used for cutting.

The Mameluke sabre has a smooth grip, narrow the direction of from front to back of the blade; e part upon which the little finger bears is very ad; the hilt has no guard so as to be light; the p is narrow in all directions in the neighbourhood the blade—thence it increases in dimensions to-rds the pummel; the weapon is symmetrical with rence to the plane of the blade; the latter, owing s shape, is strong, defends well, and has a great er of cut, to which the immense velocity with h it can be wielded, owing to its lightness, notably tributes. This sabre is well balanced, and yet its re of gravity is distant from the hilt; in conse-nce of the excellence of the stuff of which it is e, it takes a very keen edge capable of resisting roke by the real angle of its edge, while it cuts as gh that angle were much more acute. The greatest kness of the blade is not at the back; its scabbard erves the fineness of its edge; the sword-knot is t and judiciously attached to the hilt. This weapon es with the velocity of a projectile, and takes by ise—so to speak—any light object, in the same ner that a bullet would pierce a delicately hung

weathercock; it is, at the same time, capable of producing surprising effects on resisting bodies. The Mameluke sabre embodies combination of qualities such that it may be said to be perfection; it is impossible to imagine any improvement in it; as a cutting weapon, it is a *chef d'œuvre*, like the Tyrolese rifle among fire-arms.

The curved British sword (Fig. 2) has likewise great capacity for cutting; the grip and hilt are well constructed, but the sword-knot is attached at the bearing of the little finger, which is injudicious. The blade is of good steel and well tempered; it has great percussive force, is light, and takes a fine edge. This weapon is inferior to the Mameluke sabre in cutting moderately soft substances: much more so for delicate strokes, such as cutting a handkerchief in the air, or a sheet of paper placed flat on the table; but it is perhaps superior to it in its effect on hard substances, such as cutting the ashen shaft of a lance—that is to say, when the stroke should fall like an axe to avoid friction. This sword would be more powerful, perhaps, if the blade were lightened from the grip to the part A, and made heavier at the cutting part. If, with these alterations, it were not well balanced, although light, the grip might be weighted at the pummel. The cutting part should be thickest about mid-way across the breadth, and not at the back. The British sword, as a European arm, has the fault of being in no way calculated for thrusting.

Our present light cavalry sword (Fig. 45) has several faults above exposed as to the hilt, grip, and sword

We may add that not only does the hilt injure the finger in the act of cutting, but that the copper on the grip impedes that motion, and that ılinets"* being practised for a few minutes, ɜs to wear a hole in the glove, or to injure the

Its curvature is too small to have any per-ɔle effect; its percussive force is feeble in conse-ɜe of the lightness of the cutting part. The ard destroys the fineness of edge.

e old light cavalry sword termed "Bancal"† has tion of the same faults; its curvature being ɜr, however, its power of cut is increased, and of ; decreased. Its percussive force is greater, con-nt upon the width and thickness of the blade at ırt which acts in cutting.

ə horse-artillery sword (Fig. 46) is short, heavy-, and light at the part A; it thrusts very badly, ısequence of its curvature, and cuts badly because little percussive force. A straight sword of the length, made as above described as regards the , and having a wide bearing for the little finger ı hilt, would cut and thrust very much better.

ɾeral patterns of heavy cavalry swords, intended

* *Vide* note, p. 7. T.

ıis word means "bandy-legged." and is applied familiarly to this lar sword, owing to its curvature probably. Most of the weapons n the French service have similar nicknames. The short, straight, r sword, intended to be used as a fascine-knife, goes by the soubri-: "coupe choux" (cabbage-cutter). (Fig. 48). The old infantry n Napoleon the First's time, and still in use in some corps (Fig. 47), lled a "Briquet" (a steel for striking fire by a flint), &c. So in ınner with us, an infantry officer's sword is facetiously termed "a ır "a bread-earner," both of which names it seems to deserve, but rent reasons. T.

to be used exclusively for thrusting, have a blad with three blunt edges, the latter being intende to give it rigidity. The angle of the cutting edge i consequently very obtuse, and the sword but litt adapted for cutting. It is thence, I think, that arise the erroneous idea that straight swords never cut wel

The present heavy cavalry sword has the same defect as that of the light cavalry.

The old infantry "Briquet" (Fig. 47) has a hil faulty as to weight, size, and the sharp edges of th surface on which the little finger bears. The blade i tolerably good for cutting with; but with the sam weight, a much better weapon could be made.

The infantry officer's sword has not only a bearing for the little finger, but thereon are certain ornament ridges (the same ornament exists on the cavalry officer' sword, constituting in both cases, a most importan defect); the hilt is not symmetrical, the grip is no smooth, the blade has little percussive force, th curvature but slightly augments the power of cut; i should be supplied with a sword-knot.

The whole of the last-mentioned swords appear t me to be easily susceptible of improvement by th application of the above detailed principles.

Tools used for cutting differ from arms used for th like purpose, as the latter require to be light to admi of rapid motion in attack and defence,—to be shape for defence,—to be strong enough to be proof again violent blows,—to reach to a distance—and finally, t be conveniently portable in a scabbard.

We shall see that incisive power is conferred on edg

ls—first, by pressure, or by well distributed weight mbined with velocity; second, by fineness of edge, creased in some instances by the obliquity of the rection of penetration.

Billhooks, sickles, hedging-bills and scythes have all arp edges, the action of which is increased by liquity of penetration, producing the effect of an ge from two to four times sharper than it actually is.

The carpenter's plane is large as to mass, and its ting edge is oblique.

Our species of pickaxe has its cutting edges drawn a point in the centre, in order that it may penetrate e better by cutting obliquely.

The butcher's knife cuts by an alternating motion, ilar to sawing, while his cleaver, analogous in its ole length to the part A of the sword, acts without effect of curvature.

Some axes combine great momentum with oblique etration of the cutting edge.

In certain foreign states the headsman makes use of ng straight sword, which is heavy, broad, and sharp; is wielded in both hands, and strikes at a short tance from the hilt; it acts afterwards by a drawing tion up to the point. The velocity is feeble, the s great, and the effect of the cutting edge thus ch increased.

Elsewhere, a short, heavy, wide, and highly curved rd is made use of, requiring but little dexterity.

An equal amount of momentum, and an equal nentation of the effect of the cutting edge, are like- obtainable with light swords, made wide at the

part A, and highly curved. The velocity compensa for the want of mass; such swords require dexterity their use.

There are, further, certain swords used for capi punishment, which are straight and light; one de metre (four inches) wide near the end, and very thin the part A; they act consequently with the same pow of cutting as the Mameluke sabre, but they are t weak to be used in combat.

The yataghan, (Fig. 34,) the instrument used executions in the East, acts by the weight of the pa A, and the velocity due to the lightness of the weapo Its curvature does not assist in the cut.

I have seen an instrument used for the same purpo like a Mameluke sabre, but broad and thick; the h and the neighbouring parts are replaced by a lo wooden handle adapted along the back of the blad It is wielded in both hands, and has great power cutting.

The instrument used in capital punishment France, (Fig. 35,) acts like a plane, by its great m combined with a moderate velocity and a cutting ed oblique to the direction of the stroke. The combi tion, however, of the three is but indifferently arrang

PART II.

ON ARMS USED FOR THRUSTING.

CHAPTER I.

DISCUSSION OF THE PRINCIPLES INVOLVED IN ARMS USED FOR THRUSTING.

THE object of arms of this nature is to cause the point to penetrate as deeply as possible into the body struck. Let us examine the circumstances necessary to compass this object.

1. The point may penetrate either from simple pressure of the wrist, or merely by the velocity with which the weapon is moving, or by the combination of these two forces; herein it differs from the edge, which generally penetrates simply by the velocity of the sword. Consequently, in a weapon used for thrusting only, lightness is not so absolutely necessary; its weight is merely determined by what is requisite for rapidity of movement in attack and defence.

2. For the thrusting stroke, it is requisite that the blade should be rigid, so as not to break or to lose a portion of the impulse by bending.

To obtain this rigidity of blade, divers means have been employed, nearly all based on a great thickness of metal; thus:

1st. One method was to give the blade three on each side, (Fig. 8,) one towards the back, an in the centre, and one towards the cutting the latter was consequently very obtuse. This w is light, rigid enough, and little qualified for cutt

2nd. Another (Fig. 9) is to increase the thic of the metal at the back, and decrease its wid that the total weight remains the same; its rigid moderate, and the weapon cuts better.

3rd. Another (Fig. 10) is to make a highly proje edge at one side of the blade; this sword is very and rigid; but it is little calculated for cutting, as for want of symmetry as from the surface whic lateral projecting edge opposes to penetration.

4th. Lastly the blade has been made (Fig. 11) three edges symmetrically situated, as is the ca certain short swords; an arrangement which gives rigidity and lightness, at the complete sacrifice, ever, of the power of cutting,

It seems to me that greater rigidity is obtai by making the back very thick without prejudice t power of cutting, and that by way of getting rid o excessive weight consequent thereon, the back r be fluted. I have had blades made up on this and of very many differing patterns. I conside arrangement very judicious. It has moreover advantage, that the process of fluting the back l carried out after the blade is hardened, the edge re the proper degree of hardness, while the back l slightly tempered by the grindstone becomes *brittle.*

3. The stroke with the point is of two kinds. Thus h a lance, every portion of its mass moves in a direct l parallel line. The resultant of all these forces sses through the points, which has consequently mmunicated to it the total amount of the existing mentum.

The point of the battle-axe, on the other hand, only quires the direct impulse of the volume of the metal ad, while that of the handle is only communicated it by the decomposition of the forces involved.

The sword is attended with analogous effects. In inting in tierce agreeably to the regulations, it is t possible that the whole impulse of the weapon may ve the resultant of the parallel forces passing ough the point. But in the position of "Guard"* the broadsword exercise on foot, the point of the ord is higher than the wrist, and is not directed at the east of the opponent. To thrust it is necessary to vance the wrist and lower the point, so that the ferent parts of the sword move with different velocis and in different directions. Swords should vary shape according to the habitual use of the former latter system of pointing.

Let us imagine (Fig. 12) a rectangular blade having sharp edge at one of its lesser sides, to be pushed rtically against a horizontal surface intended to be netrated by the cutting edge—like a carpenter's

* The words here in the original are "en garde," and the position ms by the context to correspond to the "Inside Guard" of our ry sword-exercise. I regret not being able at this moment to refer e French sword-exercise, to satisfy the reader and self on this point.

chisel, upon the head of which a blow is struck
mallet. The resistance sustained will depend
angle of the edge, on the force actuating it, a
the hardness of the substance to be penetrated.
edge of the blade bearing on the surface be inc
instead of being perpendicular, to its long side a
plane iron (Fig. 13), the resistance met with w
diminished. The greater the inclination of the
the better will it penetrate; for, among other re
this inclination will give it the effect of being
portionately sharper, as is the case with the c
edge of a curved sabre.

Let us suppose that the edge forms an angle o
degrees with the long side of the blade (Fig. 14);
compare its power of penetration with that of a
(Fig. 15) whose edges, instead of being in the pl
one of the sides, forms a salient angle of forty de
symmetrical as regards the long faces of the
admitting in both cases that the impulse is i
vertical direction, or in that of the long side
blade. The tool having the edge in the cent
penetrate better than that having it at the
because the two faces of the edge of the form
act at angles of twenty degrees with the directi
the blow, while the edge placed at one side of th
will act at an angle of forty degrees, thus havin
cutting power.

If in the second of the above supposed cases
16) the direction of impulse still pass through the
but from a direction exterior to its angle, alth
contained in the same plane as the blade, penetr

ld take place as though the angle at the apex were sum of the angles contained between the two faces s the angle contained between the direction of ulse and the face nearest thereto.

. If the resultant of the forces of impulse do not pass ough the apex (Fig. 17), there will ensue a decomition of forces, one part tending to drive the edge the surface, and the other to cause the blade to n around it.

When the edge is at one side of the blade (Fig. 18), inclination of the face of the edge occasions a omposition of forces during penetration; the tance of the body to be penetrated acts in a tion normal to the surface, and likewise in a tanial one; the latter force tends to cause a deviation e direction of the centre of that side of the tool on h the edge is situated.

When the edge is in the centre (Fig. 19), the act of tration engenders two equal forces of deviation in osite directions, which destroy each other. The t consequently does not deviate from the direction e stroke, and has a greater chance of penetrating ly.

the blades be thicker on one side than the other . 20), in order that the edges may not deviate from line of direction of the impulse of the blow, it ld seem that the point should be in the lines coning the centres of gravity of horizontal sections of lade.

m the above it appears that the most favourable tions for penetration of the point are, that its

angle should be a minimum, and that the l impulse of the force should bisect that angle. more the line of impulse deviates from this di the less is the facility of penetration; if it pass side the point, there results a still greater l force.

5. The smaller the mark of penetration m the blade, the fewer the obstacles to be overcon the deeper, consequently, should be the pene with a given impulse. The wound will be th dangerous, not only by reason of its dept further because of the internal bleeding wh likely to ensue from a wound of small ap The wound, then, should only be of the same sions, as far as possible, as the part of the blade inflicts it.

Let us imagine (Fig. 21) a horizontal wheel re round a vertical axis, and that a blade be attac the end of a radius, the flat of the blade horizontal with its back next the axis; when th is in motion the point of the sword will des circle. If the blade have the same curvature be placed on the circumference of, this circle, penetrates an object in consequence of the mo the wheel, it will inflict a wound in the shape arc of a circle, of equal length, width, and dep the blade. The aperture of this wound will b transverse section of the blade.

If a straight blade (Fig. 22) bearing upon of the circular blade be applied thereto so as *the chord* of the arc, the wound made by the

nsequent upon the motion of the wheel will be of a pth increased by the height of the arc.

If the circular blade (Fig. 23) has reversed in position as to have the original point of the blade still in the of motion, but the convexity in the opposite rection, and forming a curve with that of the original nition of the blade symmetrical about the line ning the two points which are identical in both es, the wound made by the motion of the wheel l have a depth equal to double that made by the aight blade.

If the origin of the blade (Fig. 24) remaining in the ne situation, the point take other positions in the rizontal plane of the limb of the wheel, the wound uld be of a depth equal to the difference of the radii oceeding to the point and origin of the blade g. 25). The most unfavourable * case would be t in which the blade was situate in the line of the dius, in which case the depth would be equal to length of the blade.

In the case where the point describes a circle as ove, where the blade buries itself completely in the ject, and when the force is derived rather from an terior impulse than from a velocity, the shape and sition of the sword most favorable to penetration are s determined; the blade should follow the same e of curvature described by the point and the apex the point should be in the line of the middle of the le.

Vide the conclusion of the first paragraph of article 5 of this chapter he explanation of the word "unfavourable," as used here.

If we imagine a sword (Fig. 26) to fall vertically by the sole action of gravity, so that it has merely impulse due to the velocity, its action will be re sented by its motive power having a vertical dire and passing through the centre of gravity of the bl to penetrate deeply, the point of the blade shoul situate in this line and should be divided thereby two equal parts; the blade should be straight vertical like the line described by the points. I blade bury itself completely, the dimensions o wound will be the same as those of the blade w inflicts it (Fig. 27). If the blade were curved the line of impulse passed through the point latter would deviate from the straight line in sequence of the want of symmetry in the two cu edges which effect the penetration, the wound w be wide and the point would not reach to so gr depth. (Something of this sort occurs in shoei horse; the point of the curved nail traces a curvil path through the hoof, the direction of which originally normal to that of the surface to be trated, but which subsequently deviates from direction and finally meets the lateral surface o hoof. (Fig. 28). If the line of impulse do not through the point, there would ensue a decompo of force, one part of which would tend to causing the blade to turn around its extremity moment of contact.

If the blade be pushed in connection with a bl wood (Fig. 29) moving in a straight line, li *carpenter's* plane, and that it penetrate a body wi

y deviation whatever, in order that it should meet h a minimum resistance, the blade should be aight and lie in a direction not only parallel to the aight line traced by the centre of gravity of the ole arrangement, but further, that its line of rection should contain that point. The wound would an be of the same dimension as the blade (Fig. 30). If e sword were curved, both ends of the blade should situated in the same line of impulse, the breadth of e wound would be increased by the altitude of the rve of the blade.

If the blade (Fig. 31) moving in a straight line and nstantly remaining parallel to its original position, ve not its two extremities situated on a parallel to e line of impulse, the breadth of the wound would be ual to the distances between the two parallels to that e, drawn from either extremity of the blade (Fig.). This distance would become equal to the length the blade, if the extremities of the latter were tuated on a perpendicular to the line of impulse.

Thus, when the impulse is rectilinear, the penetra- n of the blade will, *cæteris paribus*, be a maximum hen the sword is straight and placed in the direction the stroke.

Let us now suppose a block of wood to move hori- ntally and in a straight line, like a carpenter's plane; d that this block has an horizontal axis perpendicular the direction of motion; and finally to this axis is ached a sword (Fig. 33) by the pummel in a perpen- ular direction, with its flat vertical. This sword uld be capable of motion around the axis in the

vertical plane lying in the direction of the horizont motion of the block. If the block be stationary, eve point of the sword will describe a circle when the bla turns round the axis. If the blade remain fixed the axis, and that the block move in a straight li every point of the sword will describe a straight li If the block moves rectilineally, and the sword at t same time move in a circle round the axis, and if ea of these motions have the same velocity, each point the sword will trace a cycloïd. If the blade, con quent upon the impulse, penetrate without deviati into a soft body, the point will describe a cycl therein; and that the wound should be as near as p sible of the same dimensions as the sword, the lat should be curved analogously to the cycloïd. wound is like the sheath of a sword; it cannot resem the form of the blade, unless the latter be straight circular.)

If the blade were straight, the wound would be t wider by about the height of the cycloïd.

If the blades were of a cycloïdal form, symmetrical the former with reference to the two ends, the wou would be double the width of the preceding.

The smaller the velocity of rotation in proporti to that of rectilineal progression, the flatter would the cycloïd, approaching to a straight line. Its co cavity, under all circumstances, will be turned towa the line of rectilineal impulse passing through t axis; and if the blades were curved in the inve way, the difficulty of penetration would be nea *doubled.*

As a general principle we deduce the following:—
e part of the blade which penetrates should have, as r as possible, a form analogous to the line described the point of the blade.

3. The preceding considerations will explain the sons of divers forms of tools, arms, and means of fence of animals; thus the metal of the pick-axe and ttock, as well as that of the point of the battle-axe, curved, because penetration takes place consequent on a motion of rotation. The fangs of the carnivora by turning round the point of junction of the jaw-nes as on an axis; their curvature gives them a eater power of penetration than if they were straight. is precisely the same with the long, hollow, frail, and nomous fangs of the viper.

The elephant and wild boar, which wound by rushing wards and making a stroke of the head upwards, use their tusks to describe a species of cycloïd; their sks affect very nearly that form. The same may be id of claws, the points of which act by a double otion.

The sword- and saw-fishes precipitate themselves on their enemies swimming in a straight line; their eapons of offence are straight, and lie in a direction hich, if prolonged, would probably pass through the ntre of gravity of those creatures.

Among our arms which act by the point, there are me in which the latter moves in a straight line, and ers in which it moves in a curved line. Thus, in e cavalry, all the points laid down in the regulations re given in a straight line. In the sword-exercise on

foot it is not so: in the position of "Guard" point is higher than the wrist; to give point, the is lowered smartly, and the wrist is advanced same instant. This double motion causes the p describe very nearly a cycloïd, the curvature of is analogous to, but in the inverse direction t of our blades, approaching to the curve c yataghan (the sword of the foot-soldier in the It is short, slightly curved: its cutting edge i cave). This shape (Fig. 34) is so well adapted object in view, that in France, in duels with the those who wish to make use of the point parti hold the curved sword upside down, so that position of "Guard" the edge is upwards; t gain the advantage of a curvature of blades, ana to that described by the point, the combatant sa the use of the edge and the defensive effect of t It is further to be observed that in holding the in any other way, the impulse resulting from t motions is so directed, that the point penetr though its angle were nearly double.

If a swordsman place himself at the end of tered wall, so as to be able to see along it lengt that the point of his sword be held resting the plaster; and that in this position points b agreeably to the principles of the sword-exer horseback and on foot, leaving each time the track of the sword point on the wall—we sh that the former points are nearly in a straig and that the latter are curved to about the

* *Vide* note, p. 49.

tent as our swords, but in the inverse direction, e the yataghan.

There are two ways of stabbing with a poignard either holding it like a short sword, or having the de next the little finger. Leaving the marks on e plastered wall as above, we shall find that in the st case the tracks are straight, and that in the t they are curved. Poignards should be straight the first case (Figs. 35 and 36), and curved in the cond (Fig. 37), as is actually the case. Experient and theory have doubtless pointed out to nations, cording to their manner of using them, the most itable shape for poignards.

In the mechanical arts, in nature, in the arms of rious nations, that the point should have capacity r penetration, we find that the penetrative instrument is either straight or curved in form, according the blow made therewith is in a straight or in a rved line; in the latter case the curvature closely proaches the curve described by the point.

Such is the reason and explanation: 1st. Of the *straight* form of pikes, sounding-leads, common nails, unches, &c.; of the offensive arms, of the sword- and w-fishes, of the stings of bees, of ancient swords intended to pierce through armour, of arrows, javelins, pears, and daggers of the Indians, Japanese, and Spaniards, all of which strike like the short-sword; of e bayonet, &c. 2nd. Of the *curved* form of pick-axes, mattocks, horse-shoe nails, &c.; of the tusks and claws of the carnivora; of the long, fragile, and venomous teeth of certain serpents; of the tail of the scor-

pion; of the bill of birds of prey; of the tusks of the wild board and elephant; of the horn of the rhinoceros; of the Turkish poignard, which strikes in the line of curvature traced by the rotation of the wrist round the shoulders; of the yataghan, the point of which acts like the tusks of an elephant, by a motion of translation combined with one of rotation.

Our arms it would appear, then, should follow the same rule. In the usual stroke with the point, the point of the sword in the cavalry describes a straight line, and in the infantry a curved one; the blades, consequently, should be straight for cavalry, and curved for infantry, but in the opposite direction to the existing curvature.

It is evident, that if the arms and tools above-mentioned as being curved, were curved in the opposite direction, the difficulty of penetration would be much increased. This is the case with our infantry swords.

7. The wrist gives motion to the sword, and that it should do so without loss of power, it should thrust in the direction of the centre of gravity; or in other words, in a line, which starting from the middle of the origin of the hilt, passes through the centre of gravity of the sword.

In thrusting, that the motion communicated to the sword should react without loss on the point, the stroke must be made in the direction of the line joining the centre of gravity and the point of the sword.

That the pressure by the wrist on the point at the moment of impact, should have its effect without loss, it

hould be made, in a line starting from the centre of he origin of the hilt and passing through the point.

That the wrist should communicate the maximum f velocity to the sword, that this velocity should be ansmitted at its best to the points, and that the pres- ure of the wrist on the point at the moment of impact e as great as possible, it is requisite that these three nes of impulses should coincide, that is to say, that *the ntre of gravity should be situate on the line joining e centre of the origin of the hilt and the point.* This the case exactly in the yataghan, and very nearly so the straight sword. The lines of impulse form ith each other angles, greater as the curvature of the word increases; this is the reason why curved swords re but little adapted for thrusting.

In the blade of a straight sword the centre of gravity nearer the back than the edge; but the hilt being ituated more towards the edge than the back, the entre of gravity of the sword is consequently nearer he edge than the back. In order that there should be ut one line of action of the three forces of impulse on he points, the centre of gravity should be placed at he edge; at the back its situation is the least favour- ble to the decomposition of the forces.

That the point should best resist the shock sus- ined in cutting, it should be at the back of the lade.

Finally, that the blade in the act of penetration hould have the least possible tendency to deviate om the original direction, the point should be situated n the line of the centres of gravity of the cross

sections of the blade; that is to say, it should
the centre, if at the end of the blade, the thickn
metal be systematical; and nearer the back, i
latter be more weighted with metal.

Combining these three considerations, the po
of the point should be, it would appear, in the l
the centre in the straight sword.

The apex should form an angle of forty degre
is usually the case, and this angle should be bi
by the line of impulse, taking as such a line st
from the point and abutting at one third way,
the origin of the grip, measuring from the edg
thereof; thus, this line will be situated betwee
two directions of impulse which lie very close to
other.

With this sword in a thrust, the point will o
passage for itself, its edges cutting under an an
twenty degrees on each side of the line of impu
the centre of gravity and of the hilt.

In the straight sword having the points at the
the line of impulse passes through the angle
apex, but does not bisect it; there is consequentl
force and greater difficulty of penetration.

In the yataghan there are two directions of
to be considered (Fig. 34.), and the point may v
position from the middle to the back according t
curvature of the blade. The curve thrust is
certain in its effect with the point in the centr
in the straight thrust in basing it at the back.
rally speaking, it is well placed at one third
breadth from the back.

In our light-cavalry sword (Fig. 45.), the line of impulse is exterior to the angle of the point and make with the angle of the back, an angle of about ten degrees. Its point forms an angle of forty degrees; it penetrates consequently, as though that angle mounted to fifty degrees. Besides, the velocity of the blade transmitted to the point is decomposed "to loss." The point would penetrate much better if it were situated in the medial line of the blade, having its angle bisected by the line which goes from the apex to one third way across the origin of the blade, measuring from the edge side. If the cavalry sword is to retain its present curvature, it is clearly desirable that the point should be thus situated.

With the Mameluke sabre, used in thrusting, we shall observe that the line of impulse which passes through the point and grip forms an angle of twenty-five degrees with the back of the point; the back and cutting edge of the point make an angle of forty degrees; penetration takes place by an edge inclined to the line of impulse at an angle of sixty-five degrees. The thrust would tend towards making a large wound, similar to that made by a cut; there would be a great loss in the communication of the velocity of the wrist to the centre of gravity and thence to the point. This weapon, moreover, is intended exclusively for cutting.

Several patterns of straight swords, with the point in the centre, have the two flanks which form it in straight lines, making an obtuse angle and joining the back and edge in a manner which leaves a projecting angle; this is a mistake. The point should be in the

centre, its angle about forty degrees, and its side should slope away to the back and edge in cutting curves.

It is to be remarked, that practice in thrusting makes these different values of swords to be well appreciated by the swordsman, as well as the amount of actual useful impulse they can receive and the proper situation of the points. The difference of effect is so sensible, that it is taken cognizance of by the private soldiers. Thus in the regiments of heavy cavalry in France there are various patterns of sword (Fig. 52.); that of the year xiii is straight, it has three grooves on the flats, and the point is at the back (Fig. 53.); that of 1816 is straight, the point is in the centre and it slopes off well and gradually into the back and edge. The point in both cases has the same angles, but that of the latter ought evidently to penetrate better than the former; and herein experiment and theory agree; if the effects produced in the heads and posts exercise in the riding-school be examined, we shall find that the troopers armed with the first-described swords rarely pierce the heads in thrusting, that almost all the men who succeed in so doing are armed with swords of the latter pattern, and that frequently a sharp trooper, if his own sword be of the former pattern, will borrow one of the latter just before starting.

During the time of the Empire, in some corps the pattern was altered by forming a sharp point to the straight sword of the year xiii, with the idea of increasing its power of penetration: this would be

en more judiciously effected had the point been de in the centre.*

8. Let us now examine, agreeably to what precedes, e penetrative faculty of each of the following apons: the yataghan, the straight forward, the pre- nt cavalry sword, and the lance.

First—In the yataghan (Fig. 34) the communication f force from the wrist to the centre gravity of the apon, from the grip to the point, and from the ntre of gravity of the weapon to the point, is very ll effected. These three lines coincide. The line f impulse bisects the point; the shape of the blade such that the size of its wound is a minimum, and has the least possible tendency to deviate in direc- n in the curved thrust; but it is faulty in this pect in the straight thrust. It is the best weapon isting for the curved thrust. For the straight thrust is inferior to the straight sword, but far superior to e curved sword with a curved edge.

Second—The heavy-cavalry sword (Fig. 58) of the ttern of 1816, is straight, with the points in the ntre. The communication of force is well effected; e angle at the point is bisected by the line of impulse the straight thrust, but the point acts under an gle almost double in the curved thrust. The shape f the blade is but little adapted for the curved thrust, th as to the width and depth of the wound inflicted it, but it is the best pattern in these respects for e straight thrust.

* This is actually now the case in the corps of the French army armed h this sword. T.

Third—The sword of the year xiii (Fig. 52) i adapted for thrusting than the preceding, becau point is situated at the back of the blade.

Fourth—The present cavalry sword (Fig. 44) not communicate the force so well; it penetra the straight thrust under an angle greater tha actual angle of the point; it inflicts a wider an deep wound, in consequence of its curvature and tion. These defects are marked in the curved th

Fifth—The greater the curvature of swords l a curved edge, the less are they calculated for poi in consequence of the proportionate increase (preceding defects.

Thus, in all respects, as a weapon to be us straight thrusting, the straight sword is the best for curved thrusting the yataghan is to be pre to the straight sword, which again is preferable curved sword; for all thrusts, whether straig curved. The straight sword and the yatagha preferable to the curved patterns, having a (edge; the latter deteriorate in proportion t increase of curvature.

Sixth—The lance penetrates by velocity, and pressure; the whole impulse reacts on the poin out loss. The latter moves in a straight lin weapon is straight, and is altogether const under the best possible condition for inflict wound of maximum depth.

9. The general shape of a weapon being judic granting that the wound made by a thrust sho of the same dimensions as the part of the blade

netrates, and that it should be as deep as possible, th the smallest possible opening—it follows that the ross-section of the blade, at that part which pene- ates, should have a small area, sufficient to give the ade the requisite rigidity and strength. It is seldom ecessary that the point should penetrate deeper than ne decimetre (four inches).*

10. The rules relative to the grip and hilt seem to e to be identical for both thrusting and cutting.

11. The straight sword should be light and rigid: it has capacity for cutting, that quality may be of rvice in its use. This weapon having little weight wards the point, and being slight generally, cannot netrate with facility and certainty otherwise than by e direct impulse of the wrist. For this reason the ade should be straight. By giving it a shape ana- gous to that of some swords, which have broad and ted backs, we should obtain a light stiff sword, pable of cutting. The hilt should be light, except- g at the pummel. I have had swords of this pattern ade up; they appear to effect the object of thrusting ell, and have a slight capacity for cutting.

12. Rigidity and lightness are particularly essential the bayonet; the wide-fluted back is then judicious, nd by means of this, moreover, a cutting-edge may

* I was informed by Major J. Crovone, of the Sardinian staff corps, that e Piedmontese Lancers, in the campaign against the Austrians in 1848-49, und at times great difficulty in withdrawing their lance from the body of wounded enemy. To obviate this, at the bottom of the blade a round nob was welded on, which prevented penetration beyond the requisite pth. For the same purpose the Arabs have a small bunch of ostrich thers in the like situation. The present regular Turkish Cavalry are med with lances similar to the Sardinian pattern. T.

be obtained. I have had a bayonet made up with th idea; the back is turned towards the muzzle, and th cutting edge outwards. The bow, which joins th blade to the socket, is open, giving it advantageou rigidity; by grasping the weapon by the socket an putting the index finger through the bow, both poi and edge may be used. The bayonet may thus becom an arm capable of being used in the hand, having certain value. The socket remains unaltered. Th opening in the bow gives that part greater strength which in the present bayonet frequently breaks.

CHAPTER II.

RECAPITULATION OF THE PRINCIPLES INVOLVED IN ARMS USED FOR THRUSTING.

First—Lightness in the weapon is not so necessar in thrusting as in cutting.

Second—The blade should be stiff, which involv thickness of metal; it should be light, so as to b suitable for cutting. To reconcile these condition the back may be thick and fluted.

Third—The angle of the point should be as acute a possible, and the line of impulse should bisect it.

Fourth—There are two sorts of thrusts, differin widely from each other: that in which the point move in a straight line, and that in which it describes a curv

Fifth—The general form of the blade should b analogous to that of the line described in the thrust.

Sixth—Cavalry swords should be straight, an

ıtry swords should be somewhat curved, with :utting edge at the concavity of the blade.

:venth—The point of the sword should be on the ial line of the width of the blade; its angle should isected by the line running from the apex to one- l of the width of the blade near the grip, measuring ı the edge.

ı the yataghan the point, generally speaking, ıld be at one-third of the width from the back.

ı our present cavalry sword, the point should be he medial line of the width of the blade. The line npulse will bisect the angle at the apex, as is the in the straight sword.

ı all cases the point should slope away to the back edge by curved lines.

ighth—As a weapon to be used in thrusting, the ght sword is the best in every respect for the ght thrust; the yataghan for the curved thrust; ı are superior in either case to the curved-pattern :ds with curved edge; the latter are the less ıted for both purposes, in proportion to the amount ırvation.

inth—The last decimetre (four inches) of the blade the point should, as much as possible, be pecu- y calculated for thrusting, and to this end, should ı its cross section of as small an arm as possible.

'enth—The grip and hilt are identical in using ı point and edge.

Eleventh—The straight sword should have a straight, d, slight blade, having as much power of cutting as sible. These conditions may be fulfilled, by adopt-

ing a shape analogous to that of the sword with thi
fluted back, and a light hilt weighted at the pummel.

Twelfth—This same form may be given to t
bayonet, which can be made a weapon to be used
the hand, having a certain value, and this witho
altering the socket.

PART III.

ON ARMS USED BOTH FOR CUTTING AND THRUSTING.

CHAPTER I.

DISCUSSION OF THE PRINCIPLES INVOLVED IN ARMS USED FOR BOTH CUTTING AND THRUSTING.

It is difficult for a weapon to unite both qualities in the highest degree. Thus we see in the East horsemen arm with the Mameluke sabre, which is for the purpose the most perfect pattern, and only point with the lance or straight sword.* It is necessary that we should be able with the same sword, first to thrust well, and then to cut tolerably. Let us examine what this leads to in different arms:

1. For cavalry the blade should be straight. The effective use of the cutting edge necessitates weight at the last four decimetres (sixteen inches) of the blade, while that of the point requires a small volume at the first decimetre (four inches). To reconcile these two objects, the end of the blade might be made as though for pointing only, and then slope away up to the part

* The East, for a Frenchman, means European and Asiatic Turkey. If the author is not quite correct in his statement, as the greater part of the Turkish Bashi-bazouks and other irregular horsemen are armed with the yataghan. The exceptions being the leaders and rich men, who could afford to buy a scimetar. T.

of rest of the blade intended for cutting; this may effected in two ways:

First—The hollow back of the blade may taper this point, stopping short within a half-decimetre (t inches) of the latter, and being there replaced by cutting-edge running up to the point.

Second—The fluted back of the blade may st short at a decimetre and a-half (six inches) from t point, whence the end of the blade would form a doub cutting-edge, as is usually the case, but with this d ference, that the metal should be thicker, its maxim thickness being in the centre of the width with forming a ridge, and that the swell should abut at t point.

The remainder of the blade would be, in either ca like that described for cutting, as light as possi about the origin of the blade and at the hilt, with rather heavy pummel. Swords of this pattern wo thrust and cut better than those of the present patte

I have had swords made up of both fashions. used them for nine years in Africa and found them ficient; but the second method of shaping the end the blade was the best.

In the German broad-sword exercise they hav system of cutting which is sometimes used; it is great power and unknown in France. This is done striking with the back of the blade by a pecu motion of the wrist, which adds much to the rapi of the stroke. It is more especially applicable cutting to the left-hand. It would be well to ad *this cut*, as the weak side of the trooper is his left r

ıere that the pursuer should attack the pursued. object seems sure to settle the question in favour ing the preference to the sword having a cutting of a decimetre and a-half (six inches) in length at ıck near the point, rather than to that of which ıted back reaches close up to the point.

Cavalry swords shaped like a yataghan have one ar advantage; it is this, that by means of a slight ment of rotation of the hand, the cut may be- a thrust moving with the velocity usual in the cutting, and the stroke would be consequently dangerous. I have had three specimens made: ith a fluted back: 2nd, like our present sword sed: and 3rd, with a ridge in the centre and two ıg-edges. I have tried them: they answer for at on foot better than the straight sword and *à ri* than the curved. On horseback the straight l is to be preferred, but the yataghan-shaped l is much better than the present sword.

For the infantry officer's sword, the yataghan- d blade should have the same thickness as those e present sword, but be curved in the opposite tion; the point should be at one-third of the from the back, and be bisected by the line of lse.

e back may be fluted to give the blade rigidity, he remainder of the blade be analogous to what een described for the cavalry sword.

e blade being short and less likely to bend than of the cavalry, rigidity might likewise be obtained ving a ridge to each flat of the blade, near the

back, thus forming an obtuse edge. To the facul pointing well, and of cutting well and powerfully a broad surface, this blade would have that of stri with the blunt edge of the back, so as to inflict a s wound, an advantage which might be of service u many circumstances out of the domain of actual fare. This gradation of effect would render it ferable, for instance, as the armament of policem the straight sword, which can only wound by a th that is to say, very dangerously.

I have had swords made up of these three patte the second of the three seems to me to be preferal

I will add, that if two men on foot cross swords one with a sword of the present infantry pattern, other with one of the yataghan shape, each of the adversaries will feel the superiority of the latter wea it will be quite sufficient to see them to account this.

4. The private's sword in the infantry, ter "Briquet,"* may be modified as follows: it shoul made yataghan shape, the blade should be very at the cutting part and have a point well calculate penetration, while the remainder of it should lightened by diminishing the width; the back sh be ground to an edge for cutting wood. The gre thickness of metal should be at two-thirds of the w of the blade from the edge, the point should be on line of ridge of the swell; a brass grip should c the mouth of the scabbard; it should be narrow in

* *Vide* note, page 88.

on of the width of the blade. The bearing of tle finger should be wide and smooth. This would cut and thrust well; as a weapon its point ncave cutting edges would both be serviceable, as a tool its convex edges would be found useful. had swords of this pattern made, and have tried and they appear to realise the advantages pre- by theory.

The present sabre-poignard would seem to be tible of improvement by being modified to the an shape. One of the cutting edges would have lvantages possessed by the curved hatchet, the those of a bill-hook. The point too would act : it should be situated at one-third of the width the convex edge. I have tried swords of this n; they seem to be handy.

Boarding cutlasses in the navy are not usually on the person; they are only used in actual com- ad immediately afterwards they are returned to m-rack. They do not require to be made of a le form, like cavalry and infantry swords. They l be well adapted for thrusting in combat on foot, ould involve the yataghan shape, and in addition , they should cut as well as possible. The edge be serrated at angles of forty-five, giving the n the flame-shape, while the medial lines form taghan curve. The undulations should com- at a distance of one decimetre (four inches) from int and extend down the blade for three deci- (twelve inches); the back should likewise be d to a cutting edge; the greatest thickness of

giment to have a few swords kept specially for this rpose. By applying theoretic principles in cutting rough bundles of straw, branches of trees, &c., the dier would acquire that which practice alone can ve in the use of the sword. He would use his weapon better advantage and would have more confidence it.

CHAPTER II.

RECAPITULATION OF THE PRINCIPLES INVOLVED IN ARMS USED FOR BOTH CUTTING AND THRUSTING.

First—For cavalry, the sword should be straight, id, light, and well balanced; have power of cutting, long sharp edge; the point placed in medial line the blade and bisected by the line running from nce to one-third of the width of the grip at its gin measured from the edge; the sides of the angle the point should slope away in curved lines into back and edge. The part of the blade near the nt should be thickest in the centre and be without ges; the last decimetre (four inches) should be ped specially for pointing. The hilt and grip uld be as described above.

Yataghan-shaped swords are less adapted for valry than the above, but more so than those of the ent pattern.

cond—The infantry "briquet" should be made ghan-shaped, wide at the cutting part, narrowing rds the point and origin; the back of the blade

should have a cutting edge, and the point be situ at one-third distance from the back, the angle at apex being bisected by the line of impulse.

Third—The sabre-poignard might advantageo be curved like the yataghan.

Fourth—Boarding cutlasses might, in additio the yataghan curve for thrusting, have a flame-sh portion of edge commencing at one decimetre (inches) from the points, with the view of increasin power of cutting.

Fifth—There should be three sizes of cavalry sw identical in shape, two of which should be foun each regiment.

Sixth—It would be advantageous that cavalry sh practise thrusting and cutting *in reality*. They sh practise too, the back stroke with the edge, to st on the left side.

PART IV.

EXAMINATION OF THE PRINCIPAL ARMS IN EXISTENCE USED FOR CUTTING AND THRUSTING; AND RECAPITULATION.

CHAPTER I.

EXAMINATION OF THE PRINCIPAL ARMS IN EXISTENCE USED FOR CUTTING AND THRUSTING AMONG VARIOUS NATIONS.

First—Our present cavalry sword cuts and thrusts fairly moderately well, (Figs. 44, 45,) because it has little percussive force and little rigidity; and because the point, grip, and hilt, are injudiciously shaped.

Second—The "bancal" cuts better and thrusts worse than the preceding (Fig. 51); it is susceptible of improvement for both the one and the other; it should have greater percussive force without altering its weight or centre of gravity; the point should be situated on the medial line of the blade and be bisected by the line of impulse instead of being beyond it; finally, the grip and hilt should be corrected, both being defective.

Third—The heavy cavalry sword of the pattern of 1816 (Fig. 53), is ill-made at the hilt and grip, and it is faulty in not being sufficiently rigid, in that it hardly cuts at all, and, finally, in that the point, although

situate in the medial line, is not possessed of all t faculty of penetration of which it is susceptible, owi to the ridges which slope off into it, rendering bo the cutting edges very obtuse.

Fourth—The straight sword of the year xiii has portion of the above defects (Fig. 52); moreover, t point loses much of its power of action, because it is the back of the blade, and slopes to the edge in ve nearly a straight line; so that in thrusting, this swo strikes rather with a short cutting edge than with point.

Fifth — The infantry "briquet" might (Fig. with the same weight, cut and thrust much bett because the grip, the shape of the flat of the bla the curvation and position of the point, are all faul It is tolerably well adapted for cutting, but very ill thrusting.

Sixth—The infantry officer's sword has little perc sive force, and cuts and points only moderately wel its curvature, the position of the point grip, and hi are all very faulty.

Seventh—The Mameluke sabre (Fig. 1) is perf for cutting. The British sword (Fig. 2), likewis cuts very well; these weapons are constructed different principles, but their application in each good: their defect is, that they are not adapted thrusting. The latter might be improved.

Eighth—The Turkish yataghan is an excell weapon for infantry; it thrusts and cuts well (Fig. 3 The grip has no hilt, and consequently has no guar *it likewise* leaves the mouth of the sheath open, th

lade being wider near the point than at the origin; here is an empty space at the mouth of the sheath hen the blade is home; this is closed either with a metallic cover attached by a chain, or with wax, the heaths being luted on to the grip, both methods being nsatisfactory.

Ninth—The Kabyles manufacture in the Flessa nge of mountains iron yataghans of an extravagant hape, rendering them much sought after by collectors f arms; they are very broad and tolerably thick at he cutting part; thus they are narrow up to the rip; this gives great percussive force, and the shape o far is rational; but they have further a very long, ry thin, and very narrow point which bends without lasticity, injures the power of cutting, and is but ttle adapted for thrusting. If the points were hortened, this heavy and ill-balanced weapon would e well constructed as an iron yataghan; the defects f the material, as regards finenes of edge and igidity of blade, would be compensated for by volume; would stand half way between the steel yataghan and e mace.

Tenth—The blade should be in the direction of the re-arm in the act of thrusting. To effect this, among rtain nations, the Malays for instance, the grip is clined to the blade at an angle of forty-five degrees; mong others, the Indians to wit, the grip is at right gles to the blade in their straight swords and ignards. Our system seems better adapted for fence, and for the use both of point and edge.

Eleventh—Some hilts have grooves to fit the fingers;

this impedes the motion in the hand: moreove peculiarity is not met with in the arms of n famed for using them skilfully.

Twelfth—The pummel of certain Indian swo prolonged to a length of about fifteen centin (six inches) into an inclined metal shank prot the lower part of the arm and acting as a counter This arrangement causes a loss of velocity in cu by impeding the motion of the grip in the ha would be well adapted for a sword intended to be in a duel on foot. I do not think it applicable t weapons meant for warfare.

Thirteenth—In certain Asiatic swords, the g of wood; it is three decimetres (twelve inche length, and has no bearing for the little finger reason of which may be that it is used double-ha although the blade is curved; or if used in the ord manner, that it should act as a counterpoise defence for the lower side of the arm. This p arity, though it has certain absolute advantages, not seem applicable to our arms, as it impedes th of thrusting and cutting, besides being inconveni carrying the weapon in a scabbard.

Fourteenth—The Roman swords were intend pierce armour with point and edge; the stuff having the hardness of steel, did not take a fine in the later patterns they were straight, short, edged, and heavy near the point to give perc force.

Fifteenth—The double-handed swords of the k of old were very long, broad, and tolerably thick;

ad great percussive force, owing to their velocity and olume, this being necessary to act with effect on rmour. With the same weight it would have been ite possible to obtain a greater amount of effect by e application of the principles above enunciated.

Sixteenth—Some two-handed swords were flame-haped. This arrangement, which enfeebles the rength of the cutting-edge, seems more adapted for tting into bodies not protected by iron. I think it little applicable in the present day, because, among her reasons, it involves a great width of scabbard. t is only adapted for boarding-cutlasses.

Seventeenth—The serrated edge sword, in certain raight blades, likewise has angles advantageous for netration; but as these points are weaker than a ntinuous line, this arrangement is only found in very ick weapons, such as the broad thick blades of cer-in halberds.

Eighteenth—In India there is a species of weapon sembling a bill-hook. It is semi-circular, three ecimetres (twelve inches) in diameter, and is both ick and broad in the blade; its handle is of metal, ur decimetres (sixteen inches) in length, and situated the line of the prolongation of the diameter which nnects the two extremities of the blade. Its blow ould be very powerful in consequence of the double olination of the edge. Some of these weapons have badly placed point at the part opposite the handle. his arm appears to be susceptible of a great capacity cutting, if it were improved upon.

Nineteenth—Some savage nations who have no iron,

ıave a pointed weapon which strikes by a motion ‹ ·otation like our swords; it is a short club made ‹ ıard wood, having a tolerably sharp point placed pe ›endicularly to the length of the weapon near th :entre of gravity, and projecting about fifteen cent netres (six inches). This arrangement causes th nomentum of the club to act by a point instead of by ıurface. The effect ought consequently to be great ıs to depth.

Twentieth—On the breach at Constantine we: ·ound wooden clubs, the heads of which were garnishe ıvith iron spikes, a decimetre (four inches) in lengt[h] Γhis weapon, like that which precedes, causes the clu :o act by a point instead of by a surface. The effe› ›f the blow is very great, and it is difficult to parry ›ut it requires a great rotatory motion, and conse ıuently leaves exposed the body of him who wields it ıvhereas in our system of using the point with ou ıwords, the weapon itself is in a more defensive pos ıion, it admits of striking oftener in consequence of it ıightness, and inflicts deeper wounds.

Twenty-first—Some battle-axes were shaped like ı veathercock. The blade was flat and thin; it had tw ›oints intended to strike the object, distant from eac ›ther about two decimetres (eight inches), and ha[d] ·urther, four inclined cutting edges, so that the entir :utting edge was like the letter M. The intention ‹ his weapon was to penetrate by the points and cut b he inclined lines of the M.

Twenty-second—In Asiatic countries there are, like ıise, certain weapons like a Mameluke sabre recorded

e cutting-edge is at the concave side, and the curva-
re of the blade is a complete half circle. The
tting-edge may act in two ways:—1st. By striking
the usual manner; this causes the blade to slide
the object from the point to the centre. 2nd. By
awing the weapon, as in using a sickle. It would
ppear that by using it in this manner astonishing
fects are produced. 3rd. The motion of the blade in
tting may make a deep wound by striking with the
int perpendicularly; or a less deep one, but having
eater length, by striking obliquely. The weapon,
the latter case, acts like the wild boar's tusk. This
ord is powerful as a weapon of offence, but it is
eble in a defensive point of view, in consequence of
s shape; it is doubtless for this reason that its use
very restricted.

Twenty-third—Poignards, intended to be held with
e blade next the thumb aud to thrust like a short
word, are straight; some are narrow and straight,
ithout cutting-edges; others act with a broad stiff
lade. The grip is either in the direction of the blade,
an angle of forty-five degrees to it, or at right angles
it. Those intended to be held with the blade next
e little finger are curved, and are more particularly
tended for pointing; the grip is wider, as there is no
otion inside the hand. In some of the latter species
ere is a channel ending near the points, which is
led with poison, like the fang of a viper. The poison
projected into the bottom of the wound by a peculiar
echanism.

There are, further, flame-shaped poignards. This

shape, the tendency of which is to widen the wound, i evidently faulty as a weapon specially intended f thrusting.

Twenty-fourth—The ancient Gauls made good u of an axe termed "Francisque;" its blade was roun very sharp and wide, and it was thrown with gre accuracy: its stroke must have been very powerful.

Twenty-fifth—In Asia there is a weapon of analogous nature, and which, in well-skilled hands, said to be very effective. It is a metallic quoit about four decimetres (sixteen inches) in diamet very sharp at the circumference, tolerably thin metal, and having an empty space in the centre. It thrown by giving it a sharp motion of rotation. would seem that in consequence of the combination weight, rectilineal velocity of the projectile, and circul velocity of the edge, its stroke is endowed with a gre faculty of penetration.

CHAPTER II.

GENERAL RECAPITULATION OF THE PROPOSALS.

1. *The Hilt of the Sword.*—The hilt would better made of steel than of brass; the pummel sho be somewhat weighted, the bearing of the little fin be wide and smooth; nothing should be permitted impede the motion of the little finger. The m branch should be stout, and as much out of the medi line as possible.

2. *The Grip.*—The grip should be smooth, narr

the direction of the width of the blade, especially at e points grasped by the index and fore-fingers.

3. *Distribution of Weight.*—The sword should be ht, well balanced, and have percussive power. For is purpose the blade should be stout at the last r decimetres (sixteen inches) near the point; the mmel should be proportionately loaded; the rest of e blade should be as light as possible.

4. *The Edge.*—The edge should be formed by a g-sided sharp angle at the last four decimetres teen inches). The stuff of which the blade is made ght to be such as to take a fine edge, and yet one that l resist a blow.

5. *Rigidity.*—For thrusting, the blade must be rigid. e shape which most rationally gives rigidity is that a thick fluted back.

6. *Curvature.*—The general run of a blade intended point should closely approach that of the line escribed by the point in the thrust; consequently, valry swords should be straight, and infantry swords ould have a curve analogous to the present one versed, the cutting-edge being at the concavity of the de.

7. The point should form an angle of forty degrees a maximum. This angle should be bisected by the of impulse running from the apex to one-third of breadth at the origin of the grip, measuring from edge side. The point, in general, should be in the tre of the width of the blade in the straight sword, at one-third of the width from the back in the ghan-shaped sword.

In our present pattern swords, the point would l
better placed in the centre than at the back, and bei
bisected by the line of impulse, instead of lying witho
that line, as is at present the case. It would appe
to be advisable to alter our swords in this respect.

The sides of the point should slope away to t
back and edge by curved lines. The last decime
(four inches) of the blade ought to be formed solely f
pointing. The blade at this part should have t
smallest possible area of cross-section; there should
no ridge at the greatest thickness, which should be
a line running into the point.

8. *The end of the blade.*—The fluted back shou
stop short at fifteen centimetres from this point (
inches); then the blade, as is at present the ca
should be smooth, and thicker than it is in the pres
pattern. It should have a swell in the centre witho
a ridge, the line of greatest thickness running into t
point, with a cutting edge on each side.

9. *The Infantry "Briquet."*—The infantry "briqu
should be two-edged, and be shaped like a yatagha
it should be further wide at the cutting part a
lightened along the rest of the blade. The grip sho
be formed agreeably to the principles above enunciat

10. *The Infantry Officer's Sword.*—The infan
officer's sword should be yataghan-shaped; the ba
might be fluted up to within fifteen centimetres (
inches) from the point,* the rest of the blade agreeab
to the principles enunciated.

* In the original it is "from the edge," but this is clearly a misprint.

11. *The Sword-poignard.* — The sword-poignard ght be advantageously curved like the yataghan.

12. *The Boarding Cutlass.*—The boarding cutlass ght have the yataghan shape, as advantageous in rusting, be two-edged, and form one decimetre (four ches) from the point, be flame-shaped to increase its pacity for cutting.

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18. *Sizes of Swords.*—There might be three siz cavalry swords identical in shape.

19. *Drills.*—The thumb should not be on the ba the grip in cutting. Some motions above allude in cutting should be modified, and others migh introduced. The men would have greater skil using the sword if they were drilled at cutting thrusting in reality.

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